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PAINT, CORROSION AND CONCRETE.

By Dr. Maximilian Toch.

In accepting your very kind invitation to appear before you and give you a lecture on some specified topic relative to paint and corrosion, I decided not to prepare an abstruse, intricate or

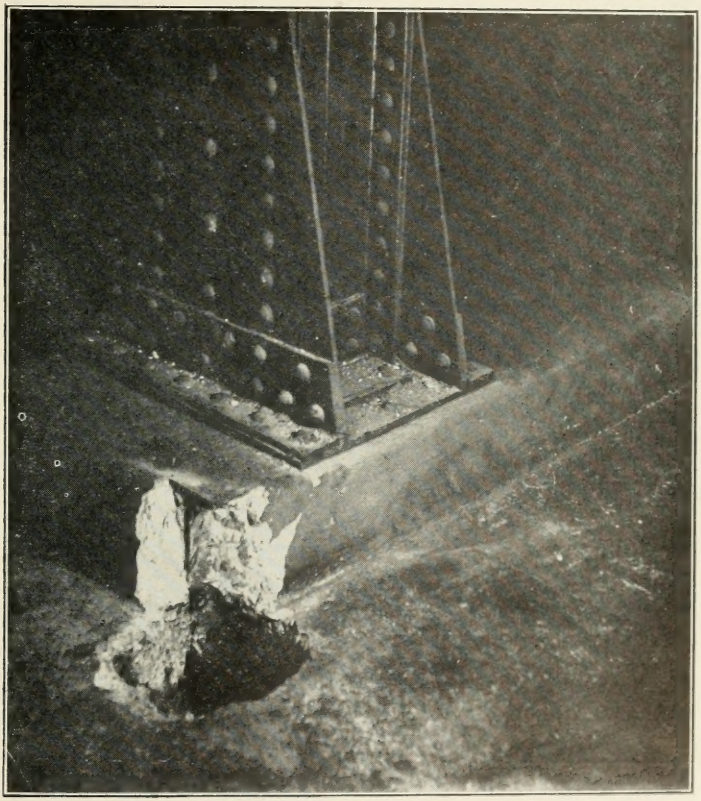


Fig. 1. Illustration of the uncovering of Grillage Beam after five years, showing its perfect state of preservation.

prolix lecture, but to give you a colloquial talk on the subject of Paint, Corrosion and Concrete, and, after I have finished outlining the general scheme, I shall be very glad to show you about 50 or 60 lantern slides which will illustrate my remarks.

As a general thing, paint is associated with the application of a decorative or protective coating by means of a brush, and

while a great deal of paint is consumed in that manner, there are large quantities of paint consumed for purposes other than for protective or decorative use.

There are a great many hundred thousand gallons of paint consumed every year in the manufacture of floor oil cloth, table oil cloth, patent leather and printing inks, all of which are paints in the true sense of the word, for they are pigments ground in

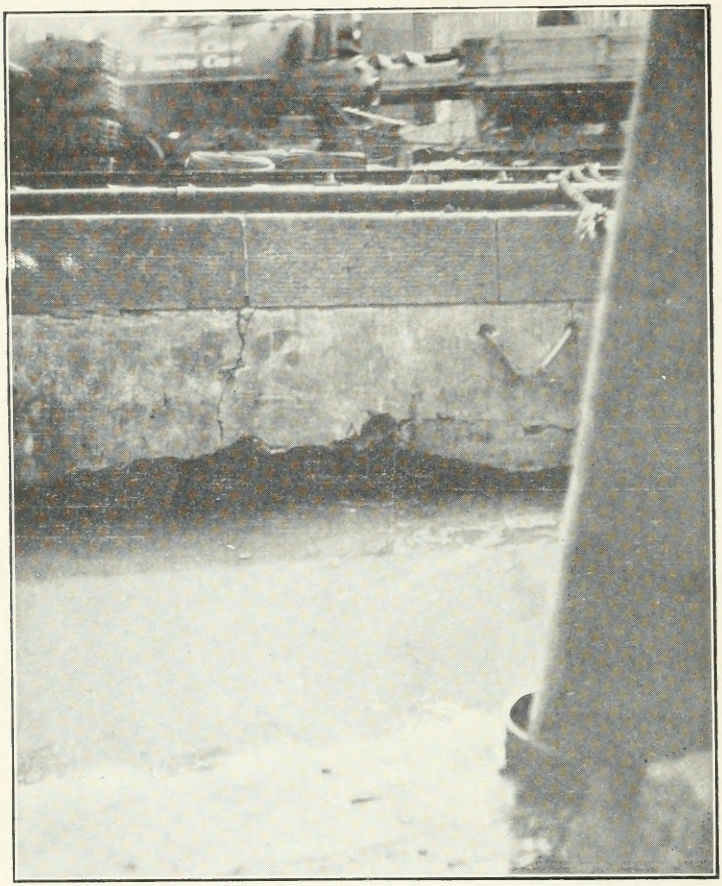


FIG. 2. A WHARF MADE OF CONCRETE WHICH SHOWS HOW SALT WATER HAS DISSOLVED IT AT THE MEAN TIDE LINE.

an oil or varnish medium and spread by means of rollers, and not by means of brushes.

Paint is an engineering material, because it serves an engineering purpose. The steel bridge of a railroad, the metal stack of a ferry-boat, or of a factory, would not last very long if it were not for paint, which prevents corrosion, and preserves the life of the structure.

There are many paints which have an inherent tendency to produce corrosion rather than to prevent it. The investigations made and now being carried on by the Paint Manufacturers' Association, at Atlantic City, Pittsburgh and North Dakota, tend to prove that paints have either a positive or negative electric characteristic. A paint which is, for instance, electro-positive to steel is now regarded as an active rust producer rather than a rust pre-

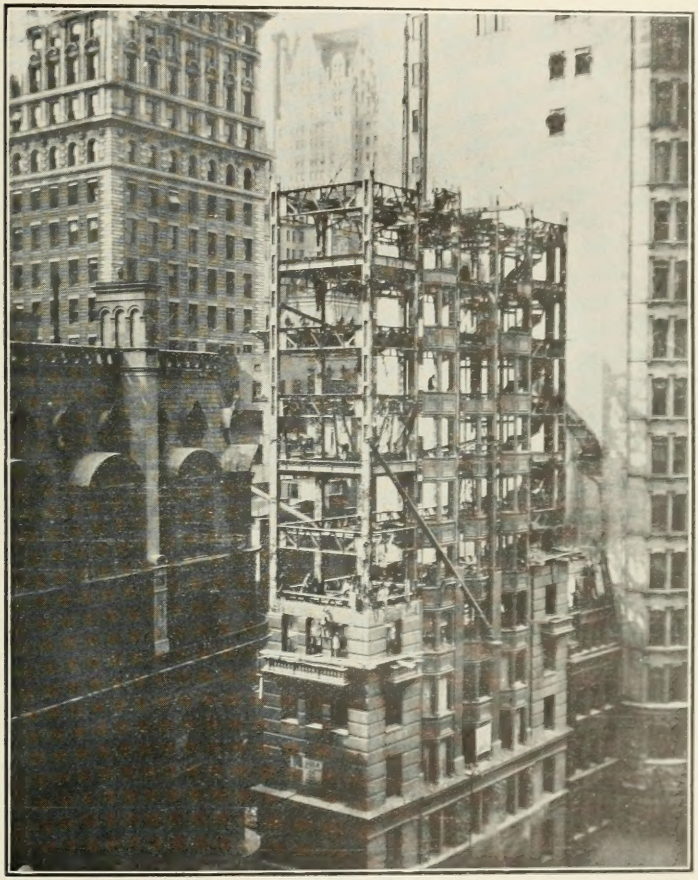


Fig. 3. Gillender Building showing Steel in excellent state of preservation after 15 years.

ventor, all of the carbons belonging to this class. At the same time this entire subject must be considered very carefully, because the theory of electrolytic corrosion of pigments assumes that there is no insulating material such as linseed oil or varnish used in connection with the pigment.

The rusting of steel in concrete is a topic which has received a great deal of discussion. There are many engineers who claim

that concrete prevents rust, while others assert the opposite. On this subject my mind is very clearly made up to the effect that concrete is not, by any means, a rust-preventing material. When engineers talk about the rust-preventing qualities of cement, they are perfectly correct, because, as a general rule cement prevents corrosion. However, concrete is not cement. It is a composite mixture which may contain anywhere from 10 to 15% of cement,

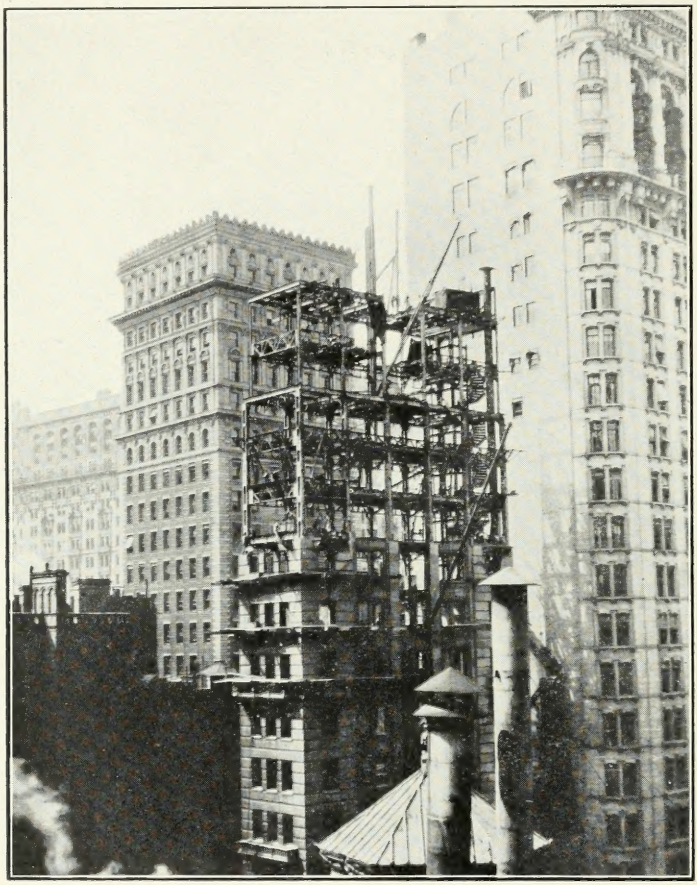


FIG. 4. GILLENDER BUILDING SHOWING STEEL IN EXCELLENT STATE OF PRESERVATION AFTER 15 YEARS.

the rest of the material being composed of broken stone or cinders and sand containing many voids, so that the chemical action of the soluble salts in cinders, the effect of the moisture in the voids, and the non-adhering quality of the concrete itself, all tend to produce rust rather than prevent it. In any case, the wisest plan is to paint steel which is to be bedded in concrete with an insulating paint containing no linseed oil and being alkali-proof; for, then

you have a material which insulates the steel against stray currents and moisture, and at the same time prevents incipient corrosion due to these causes.

One of the grillages of a large power house directly on the river front in New York City, was painted with an alkali-proof paint, and when uncovered at the end of five years, the steel was found to be in perfect condition, the concrete had adhered to the

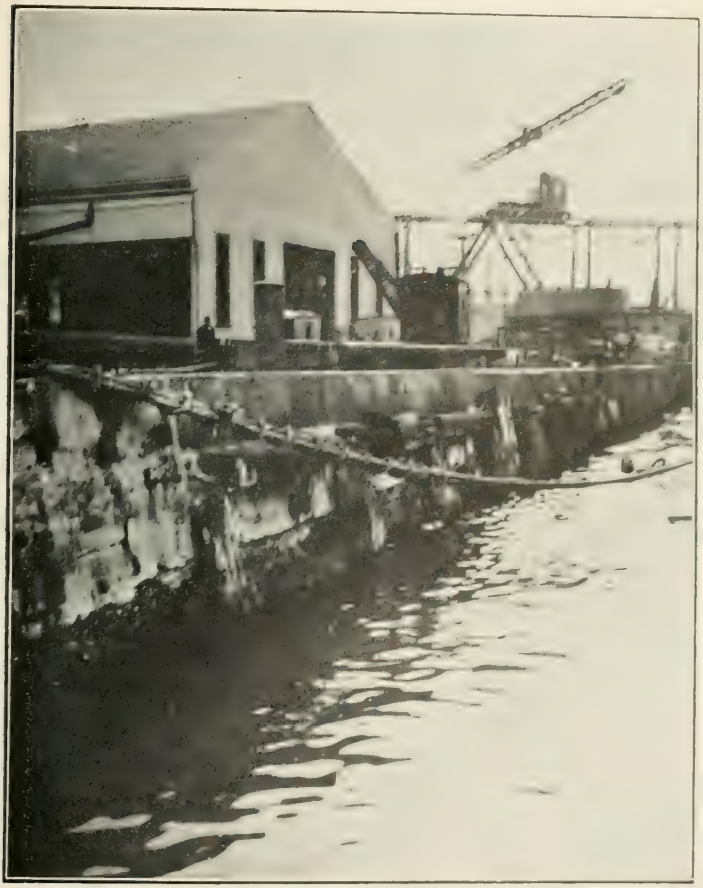


Fig. 5. A Concrete Block badly eroded by Salt Water.

paint. However, this paint was not composed of linseed oil, but was a highly insulating material of a resinous composition.

Several years ago I made the broad statement that a single pigment as a paint material is less effective than a mixture of pigments. In the winter of 1908 it was my privilege to examine the wreck of the battleship "Maine," which is one of the most gruesome masses of rust-covered wreckage imaginable. In climb-

ing over part of a steel deck, which was originally one inch thick, I broke through the surface which seemed to offer about as much resistance to my weight as an inch of cork would have done. There were no signs of paint left anywhere except on the steel mast, and this, as you will see from the several photographs, was still in a fairly good state of preservation, more than 80% of it showing the paint in excellent condition. Upon investigating this with

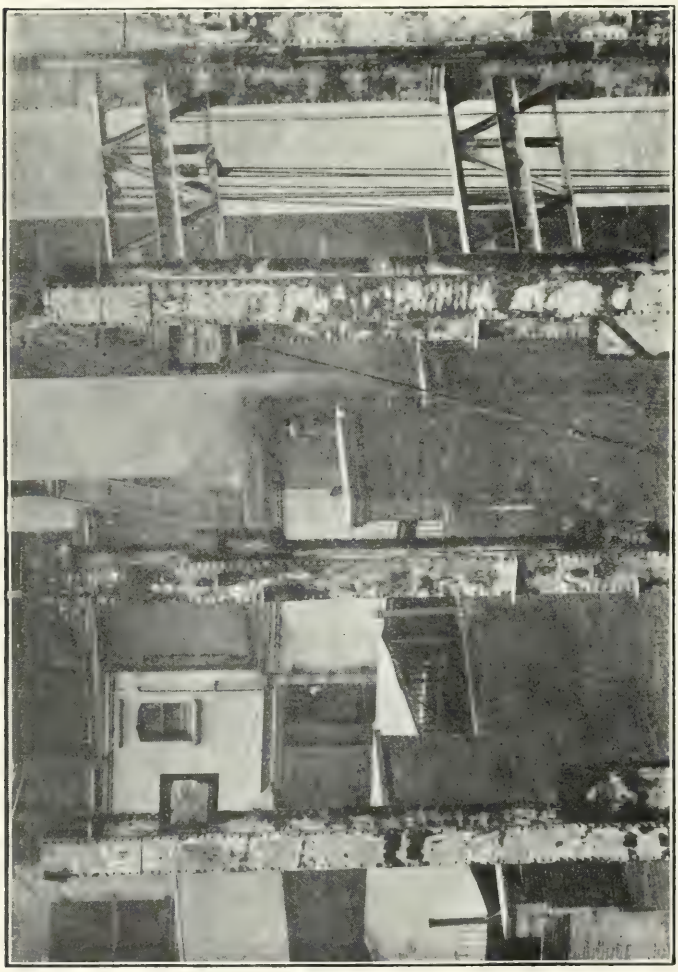


FIG. 6. SEVENTH FLOOR OF THE GILLENDER BUILDING, SHOWING RUSTY CORNER AND COMPLETE DISAPPEARANCE OF PAINT BUT IN A GOOD STATE OF PRESERVATION.

the aid of the Navy Department and measuring the thickness of some of the films of paint which I took off, I found that there were fully ten coats of paint which had been applied prior to 1898, and that this paint was a mixture of white lead, zinc oxide, Venetian red and ochre. All of the experiments of the Paint Manufacturers' Association, and the experiments of independent investigators have demonstrated that a mixture of pigments containing rein-

forcing material like oxide of iron, silicate of alumina, etc., will outwear any paint of a single chemical ingredient like zinc oxide and white lead.

We are living in the cement age. Even the youngest one of us will recall the time when cement was imported into this country, and not over 50,000 barrels per year were made in the United States. Within the last 20 years the consumption has risen from

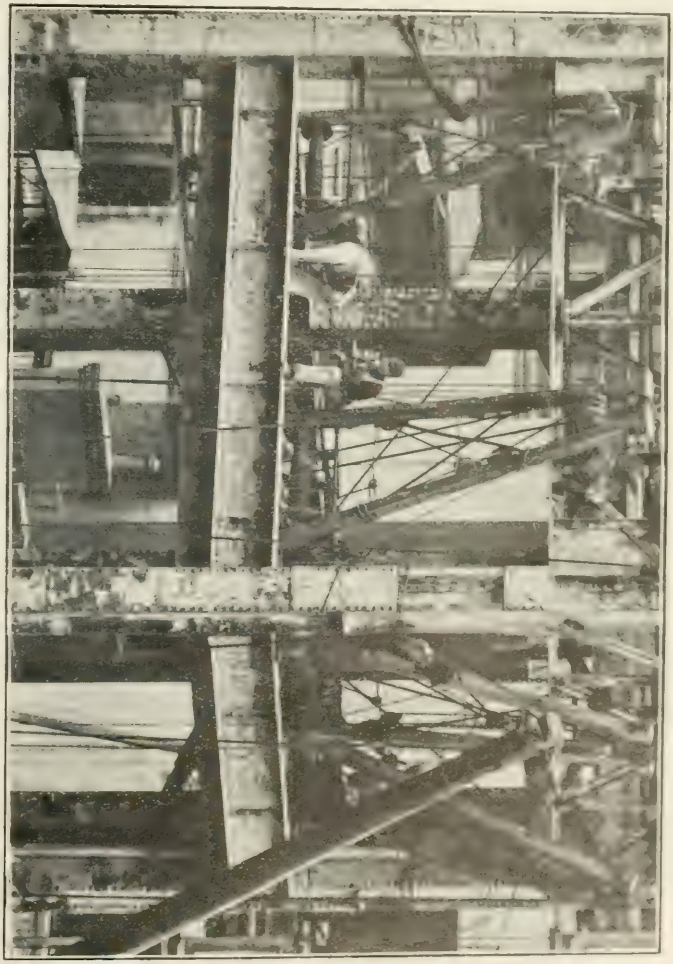


FIG. 7. TENTH FLOOR OF THE CHALLENGE BUILDING, SHOWING BUSY CORNER AND COMPLETE DISAPPEARANCE OF PAINT, BUT IN A GOOD STATE OF PRESERVATION.

50,000 barrels to nearly 55,000,000 barrels, and it is worthy of mention, that cement made all over the United States is practically uniform, complying with the specifications laid down by The American Society of Civil Engineers.

Cement in this country, or the products which are made from it, namely, cement mortar and concrete, do not show the same physical results as cement in various countries of Europe. The

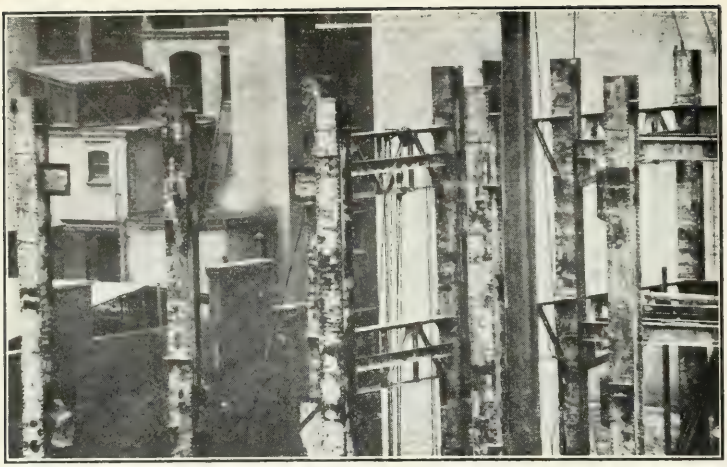
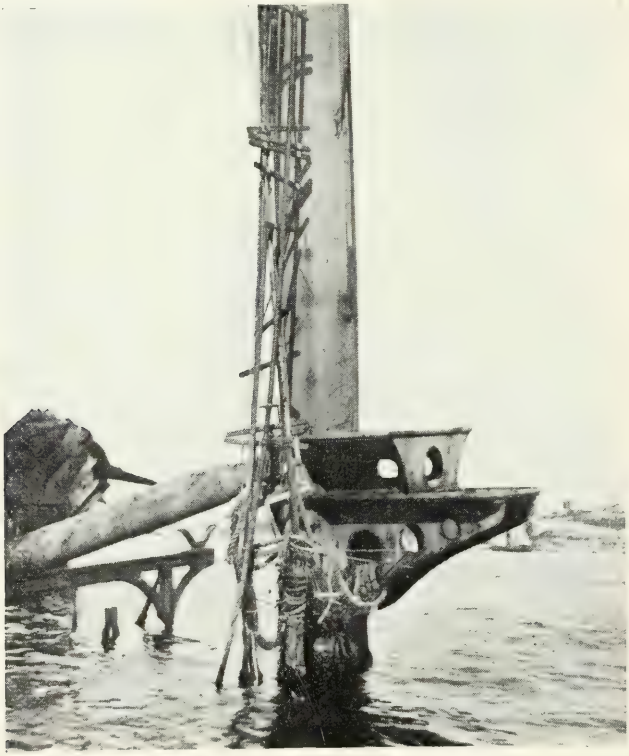


FIG. 8. SIXTH FLOOR OF THE GILLENDER BUILDING, SHOWING RUSTY CORNER, AND COMPLETE DISAPPEARANCE OF PAINT, BUT IN A GOOD STATE OF PRESERVATION.



MAST OF THE BATTLESHIP "MAINE."
The wreck is a mass of rust, except the mast, whose paint has withstood the weather for twelve years.

Belgians, for instance, have made cement tiles for approximately one hundred years, which are still in a perfect state, but the same cement tiles used in this country particularly on the Atlantic Coast do not last two years. In many instances they craze and even more frequently they crack. This is due directly to the difference in climate and temperature; for, while the mean variation in many countries of Europe may be from 80 to 90°, our mean variation is 135° or more, and cement subjected to that expansion and contraction is likely to crack. These hair-line cracks absorb water, which the sudden drop in temperature below freezing will expand into breaks. In order to prevent this several excellent cement paints have lately been invented.

In view of the fact that I have come to you as the Municipal Lecturer on Paint, Corrosion and Concrete in the College of the City of New York, I can only talk in a general way on this subject; for, while that is my avocation, my vocation is that of a technical paint manufacturer. Therefore I do not desire to mention any of the products which my firm makes, since I do not consider the exploitation of any of my materials ethical under the present circumstances. However, I am glad to show you some 40 or 50 photographs of modern building construction and the engineering features of the materials entering into their composition.

THE ELECTRIC FURNACE AND ITS USE.

By Henry M. Lane, M. E.

In the past the metallurgist has had to depend upon carbon in some form as a source of heat for all metallurgical operations. Carbon must be burned with oxygen derived from the air, and this results in a large volume of products of combustion containing more nitrogen than oxygen. All of these products of combustion are heated to the temperature of the furnace and then discarded. The products of combustion also introduce serious difficulties in the way of carrying deleterious elements to the metal. Iron and steel alloys absorb nitrogen from the air, while the sulphur from the fuel often causes serious injury. Then too, if the percentage of oxygen in the products of combustion is not kept low enough so as to insure a reducing flame, the excess oxygen may oxidize the bath of metal.

All of these facts have long been recognized and attempts have been made to minimize the bad effects by the use of the crucible furnace, which, as far as possible, excludes the products of combustion from the metal treated. The efficiency of the crucible furnace, however, is exceedingly low, and hence the process is expensive.

The electric furnace makes it possible to utilize heat without the attendant masses of gas, which sweep through any carbon fired furnace, whether the fuel be solid, liquid, or gaseous. As the electric furnace is free from the heat losses due to the flow of the products of combustion through the furnace, its heat efficiency is naturally higher, and even though the unit of heat may cost more when delivered electrically, the results may in some cases justify its use and it may even be cheaper than existing means.

The relative efficiency of the melting furnaces in common use are as follows: The crucible steel furnaces, fired with coke, has an efficiency of from 2 to 3 per cent; the reverberatory furnace for melting metal an efficiency of from 10 to 15 per cent; the regenerative open hearth steel furnace an efficiency of from 20 to 30 per cent; the foundry cupola an efficiency of from 30 to 50 per cent; while large electric furnaces have an efficiency of from 60 to 85 per cent.

The reason of the relatively high efficiency of the cupola furnace, as compared with the others, is that the fuel is burned in contact with the metal to be melted and that the products of combustion as they pass from the hottest part of the furnace ascend through the relatively cold charges, thus pre-heating the descending material. This makes the most efficient furnace possible with the carbon fuel, but at the same time it aggravates the tendencies of the deleterious elements in the fuel to pass into the metal; and

hence the process can be used only in connection with the cruder metals such as cast iron or, at times, for certain classes of bronze.

Electric furnaces are of many types, and it is difficult to draw a sharp line between the electric furnace and the electrolytic method of refining metals. For instance, the electrolytic method of refining copper employs the use of an electrolyte of copper sulphate in which are suspended alternate copper plates. Cast

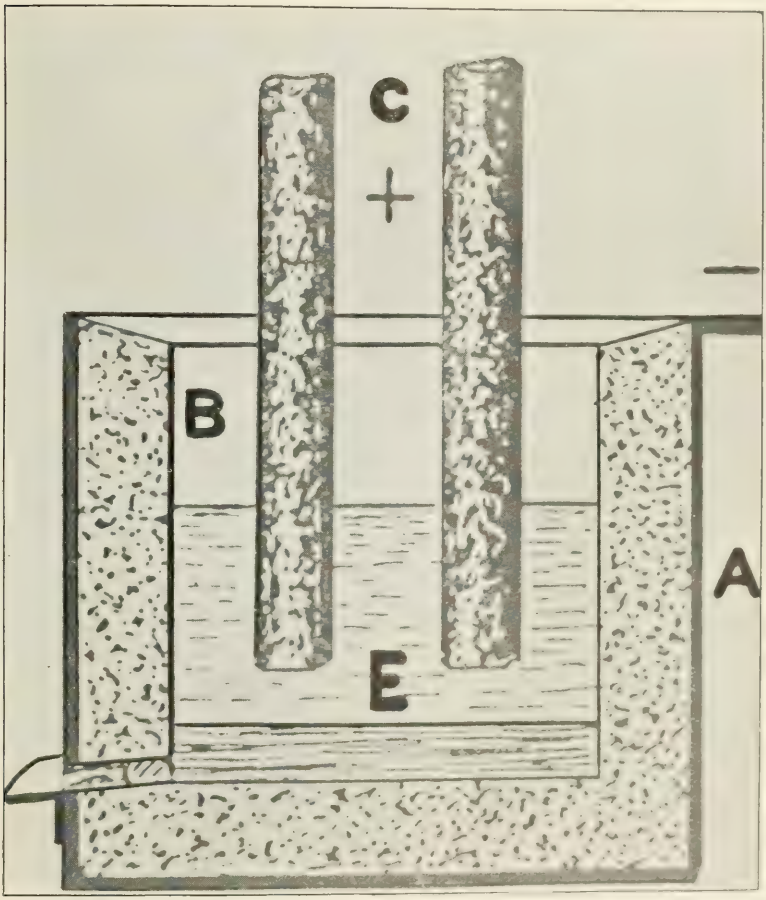


FIG. 1. DIAGRAM SHOWING PRINCIPLE OF ALUMINUM FURNACE.
A, iron tank. B, carbon lining. C, positive electrodes. E, fused bath of cryolite and refined bauxite.

plates of crude copper, know as anodes, are alternated with thin plates of rolled copper, known as cathodes. A direct current of electricity is passed from the anodes to the cathodes, the anodes being dissolved, while pure metallic copper is deposited on the cathodes, the impurities settling to the bottom of the bath. In this reaction the temperature of the electrolyte is kept relatively low

and comparatively little heat is liberated; for, the resistance of the copper sulphate bath is small. Similar processes, however, are used for the reduction of many metals, and in some cases hot baths are required.

When we come to the separation of aluminum from its ores, we find a combined electrolytic and electric furnace process. A diagram illustrating the principle of this process is shown in Fig. 1. The iron tank A is lined with graphite B. The bath E consists of molten cryolite in which is dissolved alumina in the form of refined bauxite. Carbon elements C dip into the bath at different points and through them the direct current enters. The resistance of the bath is relatively high, and hence the current passing through it heats the bath and keeps the cryolite and bauxite fused. In addition to the heating action, the current also performs an electrolytic action, by breaking up the oxide of aluminum or alumina, and reducing it to metallic aluminum. The current passes from the bath through the carbon lining to the iron tank A. The metallic aluminum settles to the bottom of the tank, accumulating under the fused cryolite and bauxite, being tapped off at intervals.

In this process only direct current can be used, and the reaction as already stated, is double, being partially electrolytic and partially direct heating by resistance.

Many other forms of electric furnaces are used for heating the charge in such a way as to cause chemical reactions within the charge. One style of electric resistance furnace is shown in Fig. 2. This is a section of the carborundum furnace. The furnace proper consists of heavy ends A and B, built up of fire brick through which there pass a series of carbon rods C and D. Between these there is a carbon core E, which, in the case of the carborundum furnace, is built up of coke. The current is conducted to and from the furnace through the conductors P and Q, and is distributed to the ends of the carbon terminal C and D by the clamps F and G.

The charge of material from which the carborundum is to be made consists of sand, coke, salt, and sawdust; the sawdust being added purely for mechanical purposes, as it is to be burned out to render the charge porous, thus allowing the gases to escape freely. When the current is first turned on the furnace, it passes through the carbon core E, which is surrounded by a charge of material H and K. As the portion of the charge LM becomes heated, the sand or silica is reduced to silicon by the carbon, and then takes up additional carbon, thus converting it into carborundum. The impurities are expelled by the intense heat, and the carbon monoxide gas, formed by the reduction of the silica to silicon, passes out through the charge and burns at the outside of the kiln or furnace. As the charge is heated, it becomes a better conductor, so that finally a considerable portion of the current flows through the charge LM. This heats more of the surrounding material, and the reducing and changing of the material into carborundum continues from the coke core E outward, until the current is so dissipated that further reactions with a given amount of current would be impossible. The furnace is then shut off,

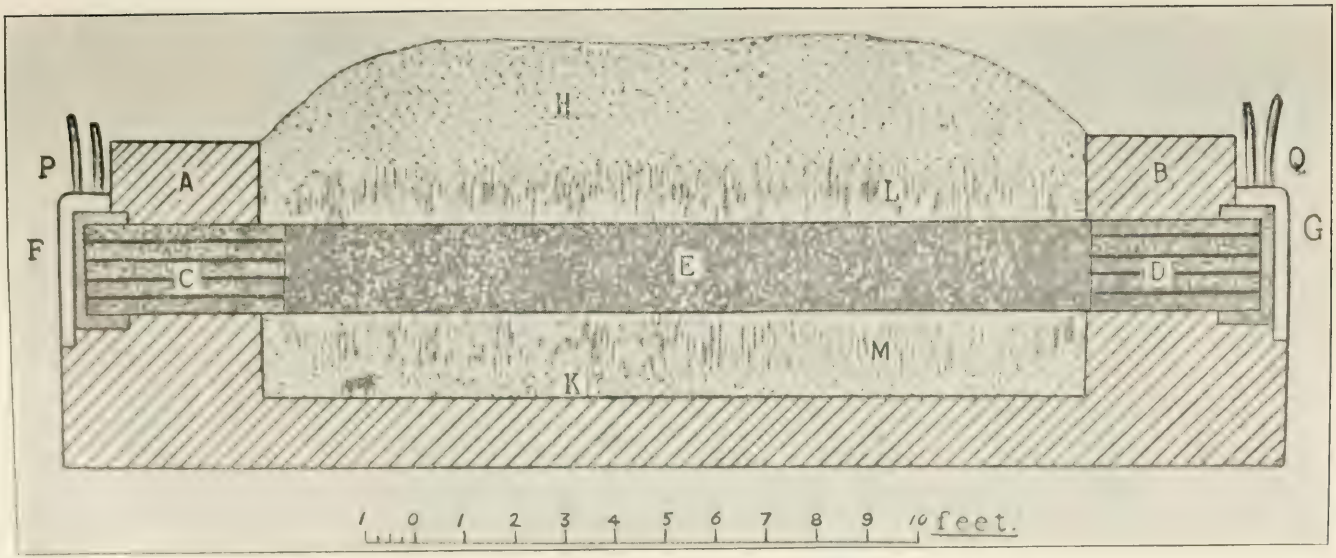


FIG. 2. DIAGRAM OF AN ELECTRIC RESISTANCE FURNACE USED FOR MAKING CARBORUNDUM.

E, carbon ore. CD, graphite terminals. FG, contacts. PQ, electric conductors. AB, furnace lining. LM, carborundum. HK, unreduced charge.

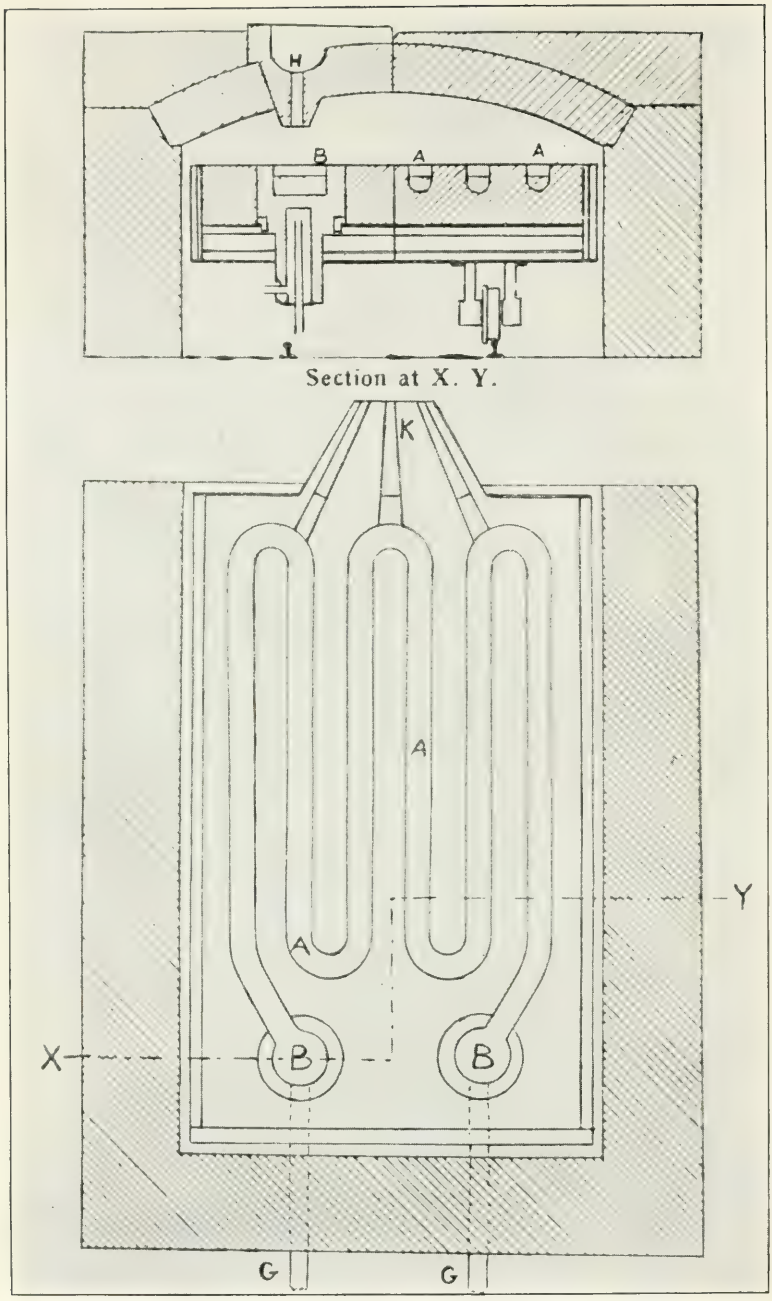


Fig. 3. Plan and Cross Section of a Ginn Resistance Furnace for making Steel from Molten Pig Iron.

allowed to cool and the material removed, the outer portion of the charge having simply served as a blanket or lining to protect the inner portion which was being acted upon.

Surrounding the carbon core will be found a dense mass of carborundum crystals, and outside of this a thin layer of carborundum which has been thoroughly reduced but not crystallized. This is sold as a refractory material and is known as carborundum fire sand.

A similar resistance furnace is used for making artificial graphite.

Another type of resistance furnace consists simply of a tube or muffle of refractory material about which high resistance wire is wound. Furnaces of this kind are used by dentists and in many metallurgical operations.

Resistance furnaces have been designed for the manufacture of steel, but have not met with much success. Fig. 3 illustrates such a furnace, which is manufactured in France, and is known as the Ginn furnace. The current enters through water cooled electrodes BB and traverses the long hearth AA. A charge of molten metal is poured into the hearth through an opening in the roof at H. The current is then turned on and serves to heat the metal and cause the reactions necessary for its transformation into steel. When the steel is finished, it is tapped off through the spouts shown at K. The hearth is mounted on a car so that it can be drawn out from under the furnace roof for repairs. The difficulty of maintaining the long channel in the hearth in proper condition and preventing the current from short circuiting across the channels makes this furnace very difficult and expensive to operate. It is also difficult to hold the metal uniform in all parts of the hearth. These are the essential features, which handicap its successful introduction.

The furnaces which have come into general use for the manufacture of steel are mostly of the arc or induction type. Fig. 4 shows a cross-section of a single-phase Heroult electric furnace. Two carbon electrodes are suspended by cranes above the furnace as shown. The ends of these carbons dip into the slag and form an arc with it. The bath is heated partially by the arc formed between the slag and the electrode and partially by the passage of the current through the bath. As the metal is the better conductor of electricity the current has a tendency to pass through it rather than through the slag, and so the entire bath becomes thoroughly heated. If the electrodes dip too deeply into the slag, the flow of current will naturally be increased. A sensitive controller has been arranged, which operates the electric regulator P controlling the electrode crane by means of the gear S and rack R, so that the electrode E is always maintained in such a position as to insure a constant flow of current. The roof H of the furnace is made detachable, and generally a spare or extra roof is kept on hand. The lower portion of the hearth is lined with firebrick and the upper portion with ground and calcined dolomite or magnesite.

For large capacities such as the furnaces at the Illinois Steel

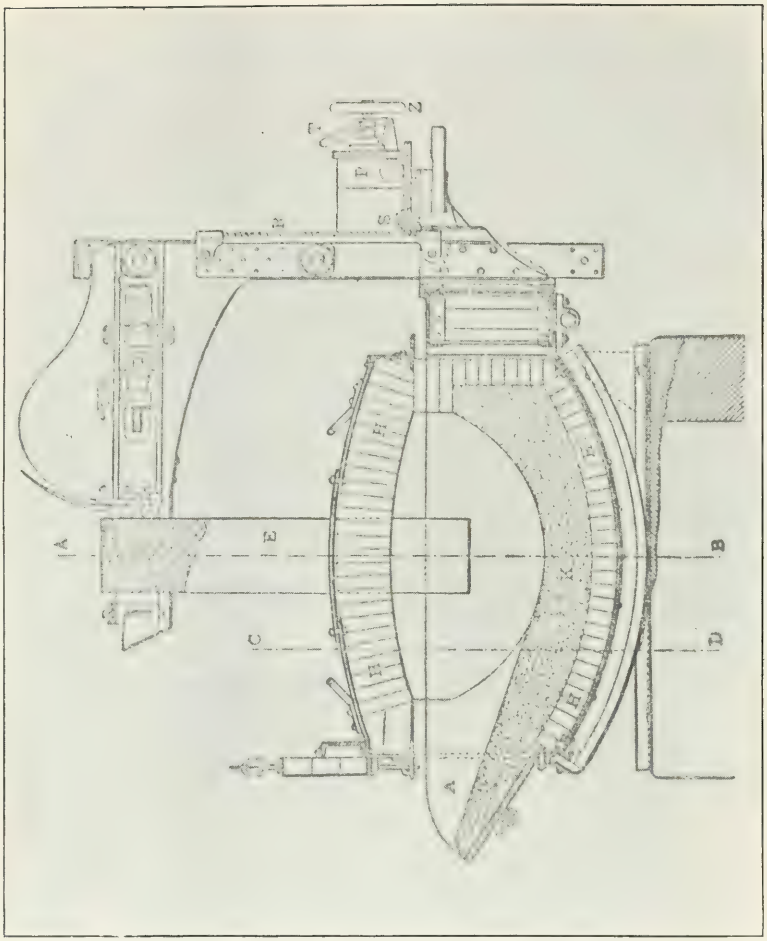


FIG. 4. CROSS SECTION OF HEROULT ELECTRIC STEEL MAKING FURNACE FOR USE WITH SINGLE PHASE ALTERNATING CURRENT.

Company's plant at South Chicago, a three-phase current is used with a three-phase arc which, of course, necessitates three electrode cranes.

A similar type of electric furnace, in use in Europe is shown in Fig. 5. This is a Kellar furnace, and the electrodes are controlled by double cranes and removed when the furnace is tilted for pouring. In the furnace shown four electrodes are used, the furnace really being a double single-phase furnace.

As a general rule, electric furnaces are arranged to tilt for pouring, as shown in Figs. 4 and 5.

The Girod electric furnace works on a slightly different principle, and is illustrated in Fig. 6. The current passes from a single electrode, hung above the bath, to the slag and, by arcing through

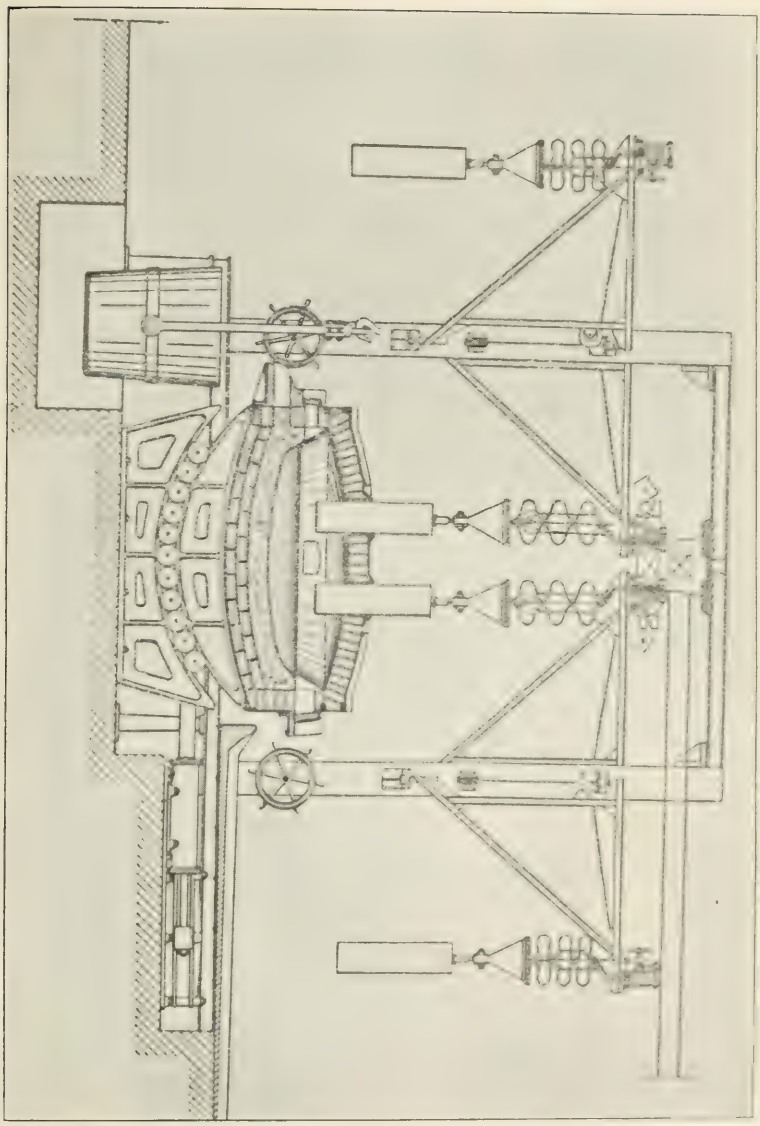


FIG. 5. CROSS SECTION OF A KELLAR FURNACE WITH DOUBLE ELECTRODE CLAMPS BY MEANS OF WHICH THE ELECTRODES CAN BE READILY REMOVED WHEN THE FURNACE IS BEING TAPPED.

this, to the metal and thence to the series of iron pins introduced in the bottom of the hearth, for carrying the outgoing current to suitable conductors beneath the furnace. It is claimed that taking the current away from the furnace through the bottom of the hearth insures a uniform heating of all portions of the bath

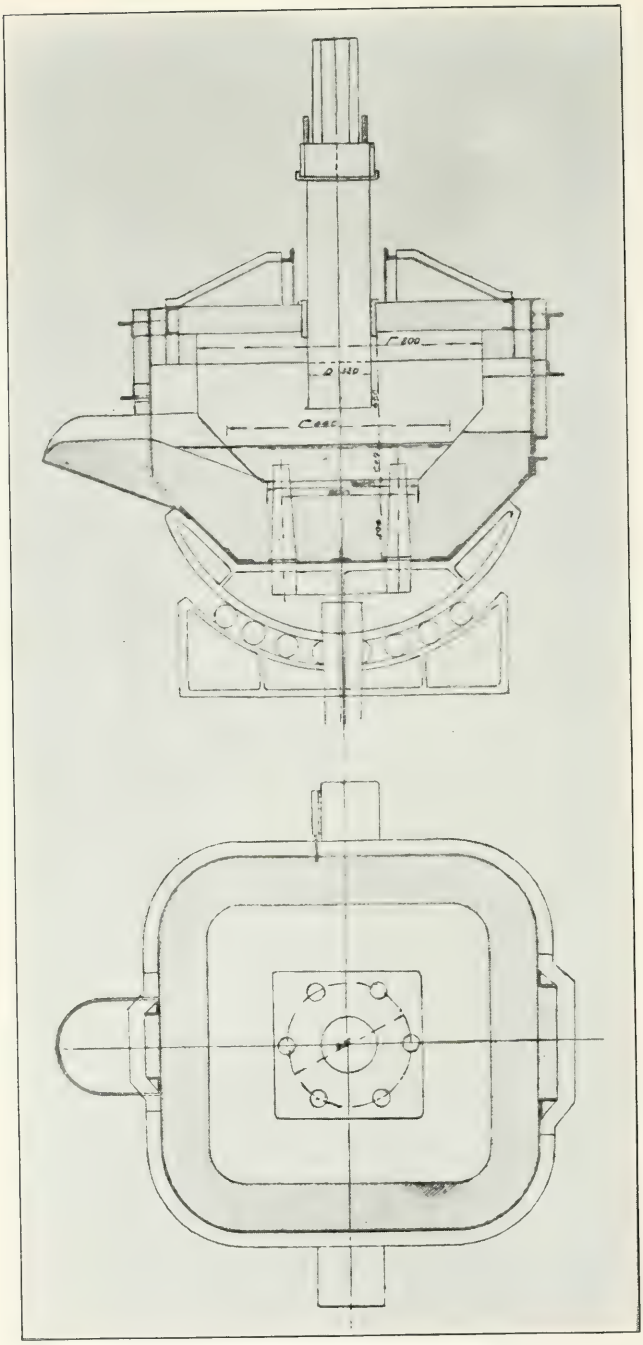


Fig. 6. Horizontal and Vertical Sections of the Girod Electric Furnace.

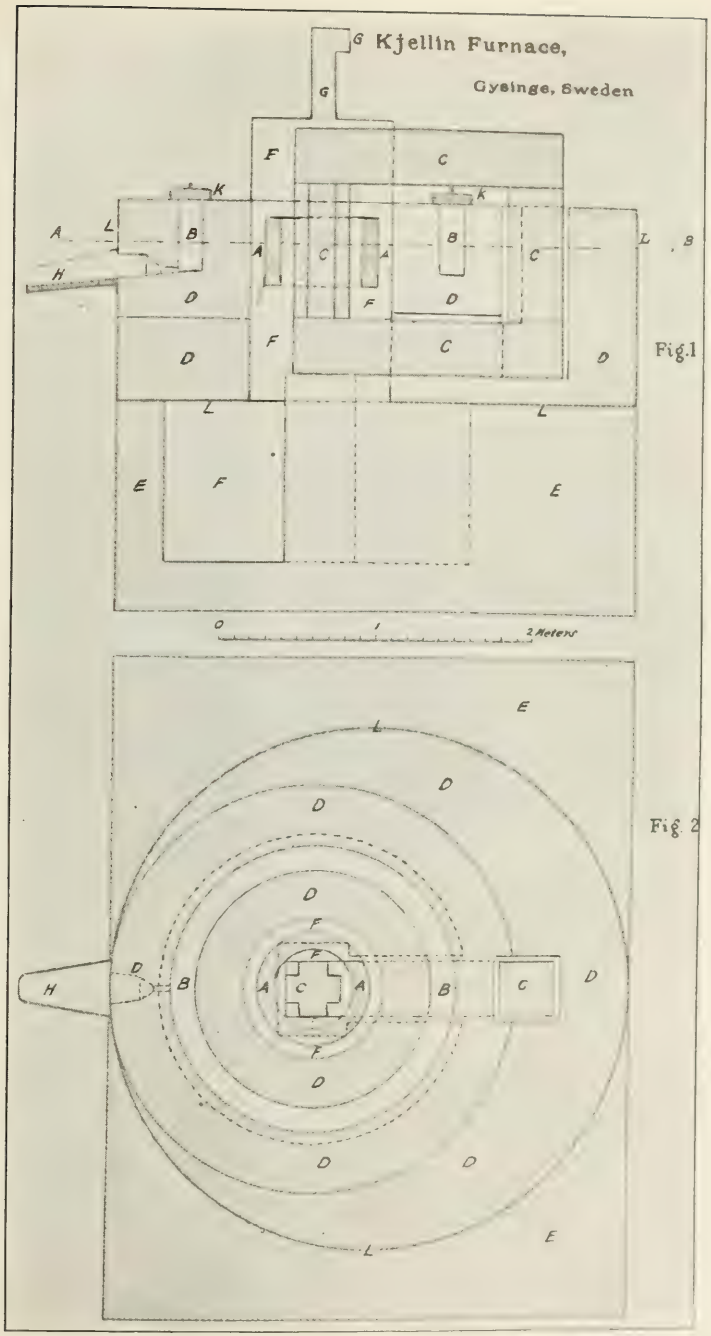


FIG. 7. KJELLIN TYPE OF INDUCTION FURNACE USED FOR MAKING HIGH GRADE STEEL OF CRUCIBLE QUALITY.

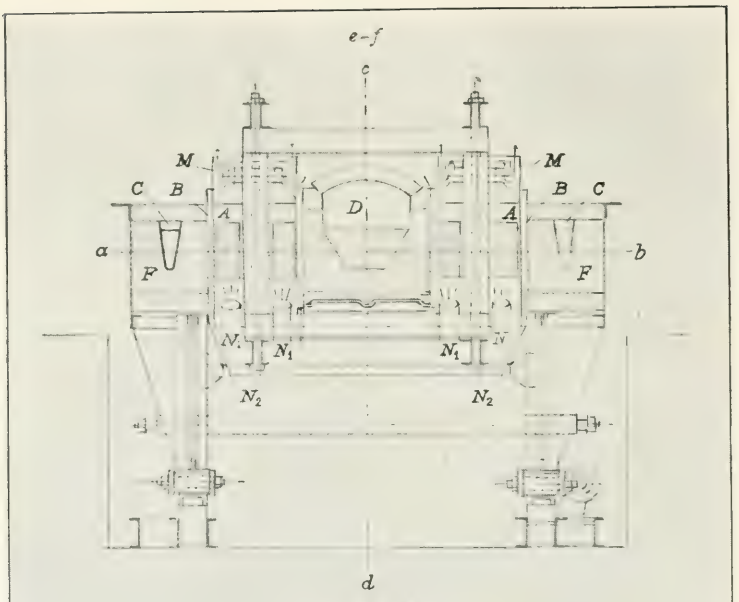


FIG. 2 (b).

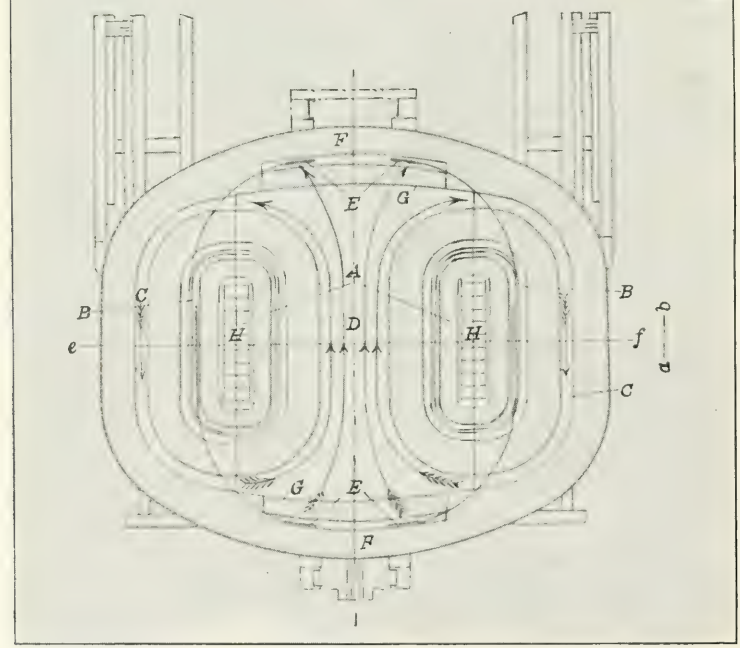


FIG. 8. VERTICAL AND HORIZONTAL SECTIONS OF A SINGLE PHASE R & R-ELECTRIC FURNACE.

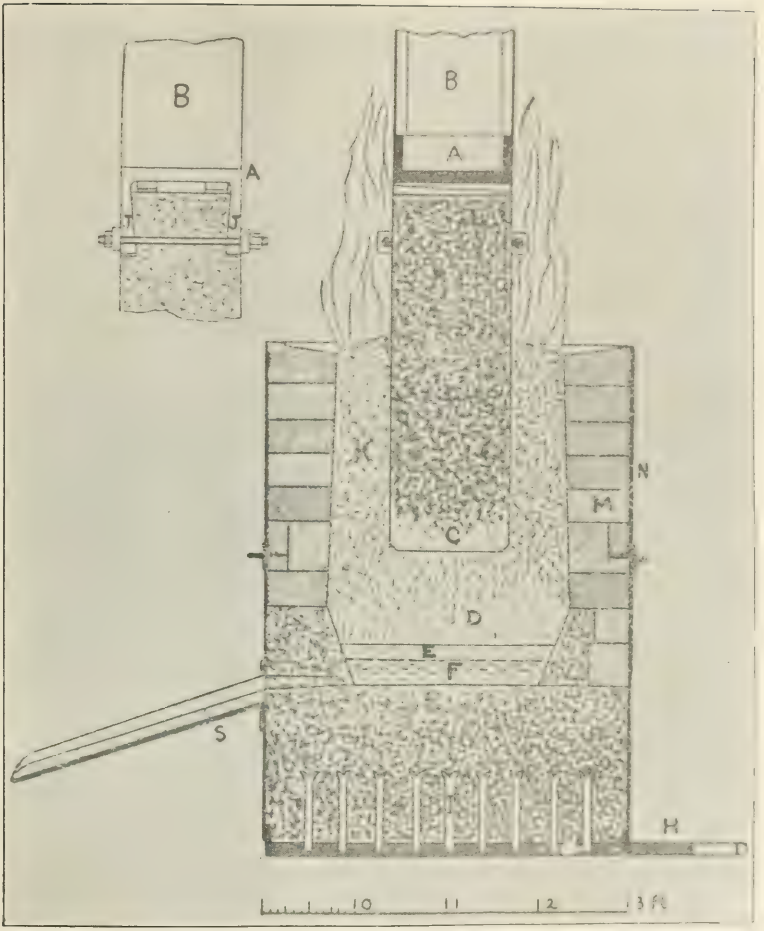


Fig. 9. Cross Section of Experimental Furnace used for making Pig Iron at 800.

Furnaces of this type are extensively used in Europe, and arrangements have been made for the instalation of several of them in this country, where the patent rights are controlled by the C. W. Leavitt Co. of New York.

In the furnaces thus far shown, the primary current passes through the material to be heated. In the induction furnace the metal is heated by a secondary current. This furnace is shown in Fig. 7, and is in reality a simple form of electric transformer. The primary current passes through the winding AA and the magnetic flux through the laminated core CC. The metal is contained in a circular hearth BB, which comprises a single turn of the secondary winding; thus the metal contained in this hearth is heated by the secondary current induced therein. Furnaces of this type

have been constructed in capacities of several tons, and are used for the making of high grade steel similar to crucible steel. Small laboratory size furnaces are also in use in many colleges and medium size furnaces are used for the production of high-grade alloys, both ferrous and non-ferrous.

Another type of furance which has come into extensive use abroad is known as the Roechling-Rodenhauser furnace, commonly called the R and R furnace. A single phase furnace of this type is shown, in section, in Fig. 8. In this furnace the bath is heated both by induction and by current which flows direct through the bath from the conductors EE, as shown in the horizontal section. These conductors connect with coils and intercept some of the lines of force, otherwise wasted, and return the energy to the furnace. The arrangement makes it possible to have a large hearth between the two channels surrounding the primary windings and constituting the two secondary circuits. This large hearth permits the use of slags for refining metal, which cannot be used in the ordinary induction furnace. The R and R furnace is also made in the three-phase type.

For the manufacture of pig iron an arc furnace of a peculiar type has been used. The experiments which were carried on at the Soo several years ago, were made with a furnace of which a section is shown in Fig. 9. The current entered through conductors A and B and a single electrode C. This electrode was surrounded by a charge of iron ore and limestone, and one-third as much charcoal as would be necessary in the ordinary blast furnace; for, in the electric smelting furnace, the carbon has to perform chemical work only. The charge below the ends of the electrode C was highly heated, the iron reduced by means of charcoal, additional carbon taken up from the charcoal the metal melted and accumulated at the bottom of the furnace as shown at F. The slag, resulting from the impurities in the ore and the limestone added, collects on top of the metal as shown at E. The current passes through the bath, slag and metal, and out through the carbon hearth of the furnace to a series of iron bars imbedded in the carbon, and finally returns to the generator through the conductor H. The iron is tapped through the spout S and the slag through a spout in the side of the furnace which is not shown in the illustration. Several tons of excellent pig iron were made in this furnace in the experiments conducted by the Canadian Government.

Furnaces which are to work on a commercial scale, however, must have the electrodes protected from the heat and must also be of larger capacity than the one shown. In Fig. 10 is shown a section of an electric furnace installed in Sweden. The lines of the upper part of the furnace follow very closely standard blast furnace design, except that the furnace is much smaller. The charge, consisting of iron ore, charcoal, and limestone, is introduced through a bell at the top. The carbon monoxide ascending through the shaft serves to reduce much of the iron oxide to metallic iron before it reaches the hearth. At the hearth there are six electrodes, only one of which is shown in the illustration. These serve to heat the material and melt the reduced iron and the constituents of the slag.

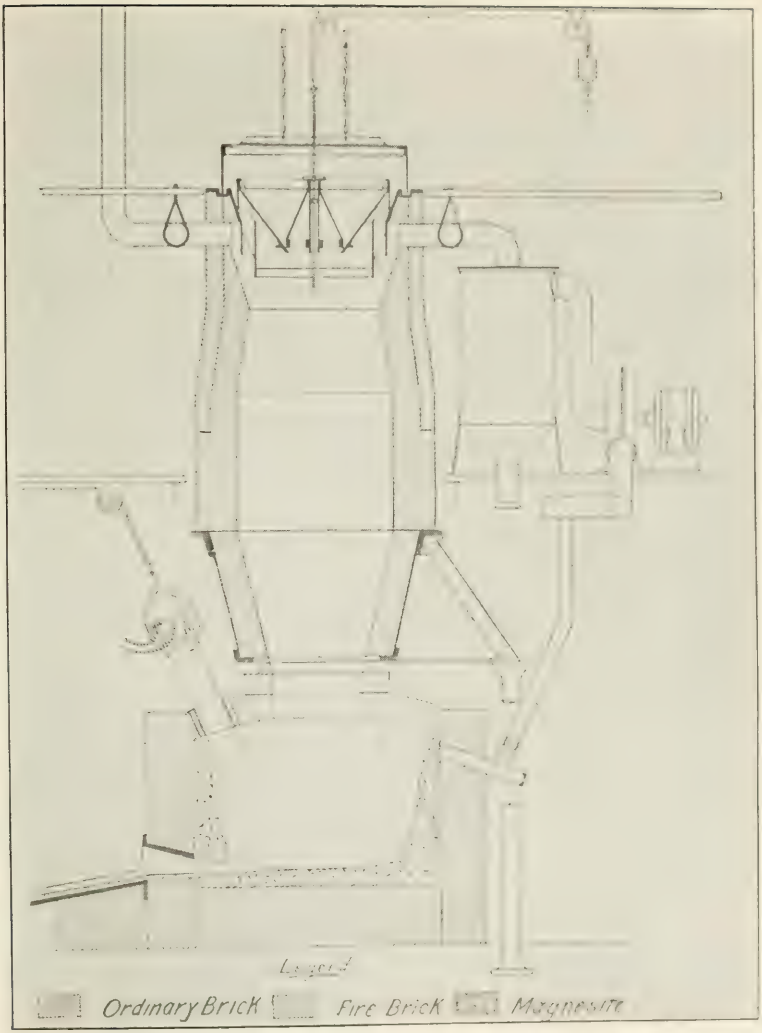


FIG. 10. CROSS SECTION OF THE ELECTRIC BLAST FURNACE FOR MAKING PIG IRON AS INSTALLED IN SWEDEN.

The iron and slag collect at the bottom and are tapped off through suitable openings. In the furnace shown, an attempt was made to take part of the carbon monoxide from the top of the furnace, clean it in a suitable dust arrester, and return it to the hearth or crucible through a series of pipes, allowing it to burn under the crucible roof.

It was found, however, that it was impossible to maintain the crucible roof in good condition when this was done, and hence the plan was abandoned.

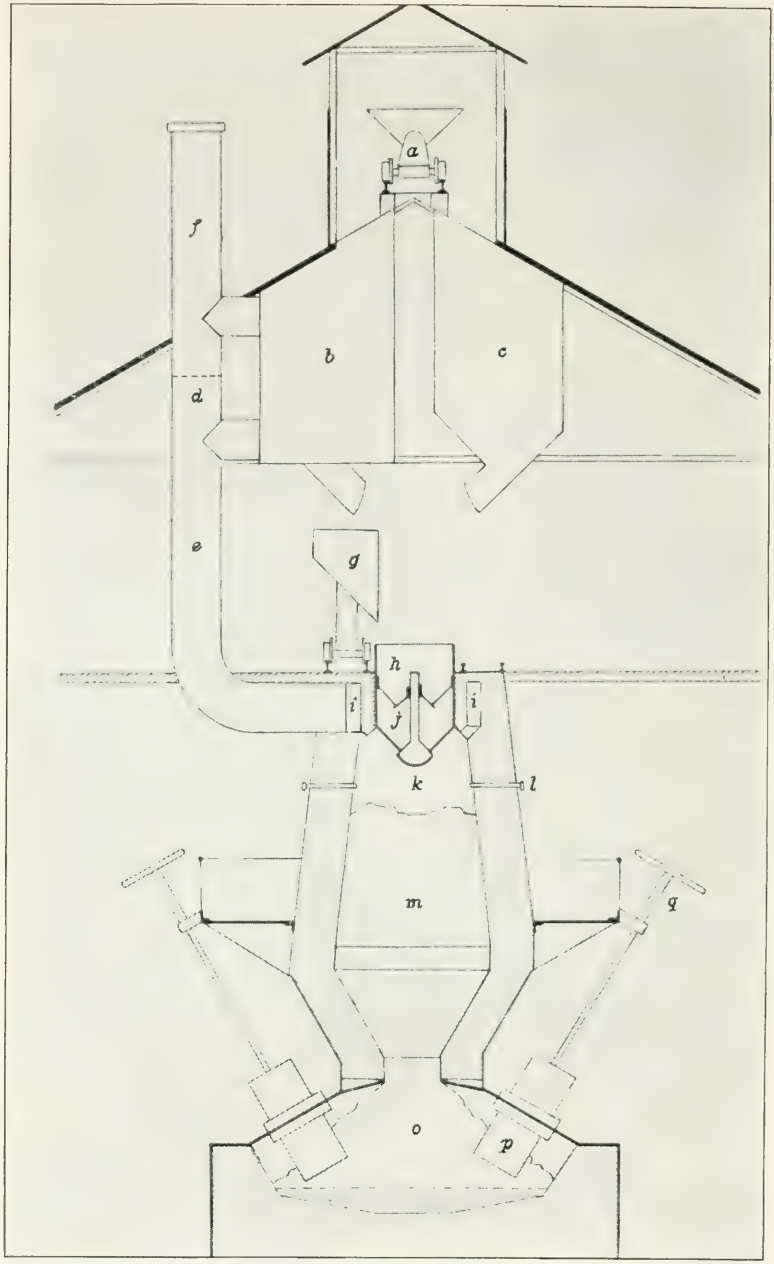


FIG. 11. CROSS SECTION OF ELECTRIC PIG IRON FURNACE AT HEROULT, CALIF.

Fig. 11. shows a section of an electric furnace installed at Heroult, California. This also has six electrodes, and, in operation,

is similar to the one already described, except that in this case some of the escaping gases are used for pre-heating the ore charge in the bin B.

Electricity has also been used for heating baths of salt or other material in which steel is immersed for tempering or for heating previous to hardening. In the present state of the art the electric furnace is a commercial success for the production of very high grade steel, similar to that known as crucible steel, and it is also probable that in a short time it will be used for refining steel melted in furnaces of other types, as, for instance, in the open hearth or Bessemer types. The United States Steel Corporation has several furnaces which are now working on this line, and are reported as meeting with marked success. The electric furnace can only hope to compete with the blast furnace in the production of pig iron in locations where pig iron is expensive and fuel expensive, and at the same time electric energy derived from water power exceedingly cheap. These conditions appear to exist in a notable degree in California and in Sweden.

It is also probable that in the future the electric furnace will be used for melting non-ferrous metals for certain purposes and for effecting a combination of cast iron and steel to produce a metal similar to that now known as semi-steel.

The electric furnace is now used extensively for making ferro-alloys with vanadium, titanium and other metals. It is also used for making abrasives-carborundum and aluminum, as well as calcium carbide and other commercial products.

THE 30th ANNUAL MEETING AND BANQUET OF THE CLEVELAND ENGINEERING SOCIETY.

By Chas. H. Wright, B. S.

Past President of the Society.

Our annual meeting held on June 14th, was, as these meetings almost always are, a success; every one who was present passed an enjoyable and instructive evening. Any person, except an Engineer, who was present at that meeting and looked over the body of men assembled there would have said without hesitation, "Here are men who do things," "Here are men who make themselves felt in the civic and business life of the city." Any engineer who was present knew better, however.

Engineers as a body belong to a peculiar species; there are some animals who hibernate for a portion of the year and during the remaining portion show considerable life and animation. There are other animals who do not hibernate at all, they are more or less alive during the entire year. Engineers so far as their club life is concerned belong to neither of these classes. Upon one day in each year, the day of the Annual Banquet, they are very much alive and full of enthusiasm. During the remainder of the year we see and hear very little of them.

Year after year we older members have attended these meetings, have listened to inspiring talks about the things we should do and the opportunities which are lying waiting for us to take them up. We have passed a pleasant evening, have gone away with the hope and belief, apparently, that some of these things would be done; and then every one has forgotten all about them until the time for the next Annual Banquet comes around, when we all come back and listen to these same talks over again and with the same result.

Apparently we do not, ourselves, see the humorous side of this situation. Year after year we have seen committees of capable men appointed to investigate and report upon matters of importance to us as members of the club, and also as citizens of Cleveland; year after year we have seen these committees accept their appointments and then be so busy with their own affairs as to forget all about the committee work. It is seldom that investigations and reports are made, and apparently no one has the slightest idea that they would be, with the possible exception of the new officials who make the appointments.

We are starting in the new year with a set of officials as capable and as enthusiastic as those we have had in the past; let us hope that this year will see something accomplished which will place the Club more nearly in the position it should occupy in this community.

The dinner which occupied the first hour of the banquet evening was furnished under the direct supervision of the Athletic

Club, which fact alone is sufficient proof of its excellent quality, both in materials and in service.

We were fortunate in having with us, as toast master, Prof. Benjamin, who in past years has been one of our most efficient and faithful workers. His special fitness for this position was no doubt gained while exercising his duties as an officer of this Club.

We, all of us, think of many bright and witty things, but few know how to say them effectively. A past master in this accomplishment was our guest, Rev. Geo. Fred Williams; he told us one funny story after another so fast that most of our slow thinking members were always three or four stories behind with their laugh. A few members whom I met weeks afterwards were then just getting ready to laugh over some one or other of these stories.

Our incoming president, Mr. Frazier, found written under his name the words "Much may be made of a Scotchman if he be caught young;" he had evidently made up his mind to show us that he was caught while still a very small boy. His address appears in this number of the Journal.

It was a source of a great deal of pleasure to us older members to be able to meet and talk again with Mr. Gobeille, a man who was known and loved by every member of the Club, whose membership dated up to the time of his leaving us a few years ago. Mr. Gobeille told us entertainingly something of the early history of the Club and the men who had been prominent in its affairs in the earlier days. It is evident that although Mr. Gobeille is no longer able to be with us regularly, he still has a warm spot in his heart for the Club and its members. May we have the pleasure of having him with us many times in the future.

Judge Taylor gave us an interesting talk upon the intimate relations existing between the law and the work of engineers, he brought out the point which many of us have realized that men trained in a special line or department of work are not as well fitted to grasp and consider a problem in all its multitude of phases and bearings, as is the lawyer whose training has been such as to enable him to do this; but he is in turn unable to grasp the engineering sides of many problems of which he is called upon to consider. The lawyer and engineer working together apparently make a pretty strong team.

Our retiring president, whom we loose in his official capacity with regret, gave us an interesting address which appears later in this issue.

The intervals between the speeches were enlivened by songs and music, and during one of these intervals an inquiry was made if any one present had seen Kelly. Being one of the older members I felt that I should know this gentlemen, but when I found that no one present seemed to have any more definite knowledge of him or his whereabouts than I did, I felt relieved.

I believe if the 110 members and guests who were present at the meeting felt as I do that, possibly, the welfare and prosperity of the Club would be very materially increased if we could arrange to hold an annual meeting at intervals not exceeding two or three weeks apart.

PRESIDENTIAL ADDRESS.

By Robert Hoffmann, C. E.

The enormous growth in the amount of public work done from year to year in our American cities is an interesting subject to study. From every large city are heard reports of vast public improvements. In New York City millions have been spent in extending a water supply that required the building of a conduit one hundred miles in length in order to conduct pure water from the Catskill Mountains to the metropolis. Several large bridges costing from sixteen to twenty-three million dollars each were erected so as to carry the ever increasing traffic across the waterways surrounding Manhattan Island. In the extreme western part of the United States, in Seattle, a veritable mountain in the center of the city was leveled off so as to convert the topography from the form in which nature had wrought it to a condition required by urban necessities. Galveston surrounded itself with a sea wall miles in length, and Chicago, through its sanitary canal, is pouring water from Lake Michigan into the Mississippi river. Undertakings of a similar magnitude are known to be going on in the cities of Europe, and all the civilized world. Wherever large masses of people congregate, similar demands for public improvements arise. This wonderful growth in public work, no doubt, finds its source in the conditions that follow the growing tendency of mankind to flock toward the centers of population, our modern cities. This congestion of population has made sanitary provisions necessary, hence extensive water supplies, sewerage systems, pavements, bridges, institutions, parks and the many other structures and works our modern civilization demands. This growth in public work is comparatively recent, probably keeping pace with the sudden increase of population in our cities.

In our own city of Cleveland the recent elections in reference to bond issues for public works are conclusive evidence that locally conditions are no exception. In reference to the amount of public work accomplished and projected, Cleveland is probably an average example. Nearly all problems confronting other large cities have been met or are being considered here, so that an analysis of local conditions will largely represent general experience.

What has been accomplished is of less interest than what is projected, and I desire to present some of the proposed or suggested improvements, together with an approximate estimate of their cost, and endeavor to draw some conclusions in regard to the relation such cost bears to our ability to pay for them.

Fifteen years ago the park system was comparatively small in extent and was used practically only by the favored few fortunate enough to own conveyances. To-day the large majority through ease of access has been educated to make use of the pure air and

recreation afforded so that the parks together with our boulevard system have become almost a necessity. The various parks are so placed about the city that ultimately with their connections a long grand circuit of boulevards 22 miles in length will circle the city, except along a portion of the lake front, extending from Gordon Park on the east to Cuyahoga River on the west. In order to complete this system about fourteen miles of boulevard remain to be secured. Woodland Hills Park must be connected with Garfield Garfield with Washington, Washington with Brookside, and Edgewater with Superior Viaduct. A portion of these connections have been provided for, but the completing of the system as outlined would cost from four to five million dollars, depending largely upon the nature of the improvements. The lands which have been secured for park purposes represent to-day a much larger value than paid, it being estimated that such value has increased from a cost of over five millions to a value of over twenty millions. Donations and lands bought a long time ago account for a part of this increase. Not only do park lands increase in value but their development has a direct effect upon the neighboring territory, creating a long belt of desirable residence property.

In the class with parks may be placed projected public bath houses estimated to cost $80,000; the zoological garden additions costing $40,000; aquarium, $25,000; botanical garden, $30,000; play grounds, $40,000.

Among public buildings to be located in connection with the so-called group plan there has been mentioned a new city hall, costing two and one-half millions of dollars, and a public library. On the West Side the market house is to be completed at an expense of $200,000.

For the care and relief of the infirm and unfortunate much has been done. The broad expanse of land at Warrensville, where pure air, good care and attractive surroundings are assured the inmates, affords a suitable setting for a collection of buildings designed for charitable and penal purposes and admired by all that visit them. Pitiful it seems that so many of our fellow beings should be reduced by want or disease to the necessity of seeking a public institution in which to pass their declining years. How satisfying it is to know, however, that the city is doing what it can in easing by slight comforts and sanitary surroundings the plight which adversity has brought about. An elaborate plan of institutional buildings has been prepared, but only a small proportion of such buildings has been constructed. The grounds are still to be improved, drives and walks constructed and additional service facilities installed. To complete this scheme as outlined at the Infirmary will require at least one million dollars. In the vicinity of Correction Square, the location of penal institutions at Warrensville, only a good beginning has been made and several buildings and structures remain to be erected. It will probably require a million dollars to perfect the plan as outlined. Located on the high ground of the large Warrensville farm is the site of the tuberculosis hospital estimated to cost $250,000.

The city hospital as projected, which is to occupy the site of the old infirmary on Scranton Road, is to cost $1,250,000, and provides for a series of modern hospital buildings, to replace the present old out-of-date buildings.

Four new fire stations should be erected and together with equipment would require two hundred thousand dollars. One of these is proposed at Detroit Avenue and West 112th Street, one at Lorain Avenue and Denison Avenue, one at Carnegie Avenue, near East 79th Street, and one near Lake View Cemetery. The city's danger on account of the fire risk has often been commented upon and the necessity for additional fire-fighting equipment cannot be questioned.

The Cuyahoga River, originally a shallow, comparatively narrow stream, has become an important artery of commerce, and millions of dollars are invested along its crooked path. The welfare of a large percentage of the city's business interest is so intimately connected with the condition of our river that large expenditures must ultimately be made in the Cuyahoga River valley. To date the city has expended nearly three millions of dollars in improving and maintaining the river. It has been placed in a condition that has admitted of the location of three large blast furnaces up stream over five miles from its mouth. But increase in the size of vessels has been even proportionately greater than our river improvements and to-day there exist many narrow places, annoying bends and other obstacles to navigation. Cuyahoga River is one of the terminals of the great lakes navigation routes and the city must insist that the stream be kept in a condition so that whatever vessel floats and finds its way to this port may find an easy channel and proper berth along its docks. To accomplish this much desired end requires the widening of several portions of the old channel, principally at several bends in the river between Center Street bridge and Central Viaduct. Furthermore, in order to make the large tract of manufacturing land available up stream above Clark Avenue, the river channel should be straightened by some large cut that will obviate the necessity of vessels passing around the so-called Irish town and Collision bends. Such a cut would shorten the round trip to the Upper river by two and a half miles. The widening is estimated to cost at least six hundred thousand dollars, and the cut recommended for straightening the river would cost one and one-half million dollars. It has also been suggested that the city should participate in the extension of the Upper river from a point about fourteen hundred feet above Clark Avenue to Harvard Avenue. This is the district so often mentioned on account of its great manufacturing possibilities, traversed as it is by several railway lines, the Cuyahoga River, the Ohio Canal and located so near the center of the city as to be easily accessible to every section of Cleveland. Nearly two miles of navigable river could be here added and there is no doubt about the propriety of the city at large contributing its share towards this development. It has been proposed that the city should do the necessary dredging, provided property owners

donate the land and protect the banks by suitable bulkheads or docks. Such dredging might cost two hundred and fifty thousand dollars.

Intimately connected with the river problem is the bridge question. The old time swing bridges with their center piers offer a most serious obstacle to navigation and it must be looked upon as almost a blessing that some of these bridges are getting so old that they must soon be rebuilt. In this class may be placed the Main Avenue bridge, Lower West 3rd Street bridge and the one at Upper West 3rd Street, which is still being swung by hand power. Each of these bridges should soon be replaced by some modern type of lift or bascule bridge which admits of quicker and easier operation and provides a wide, practically unobstructed channel. These bridges would involve an expense of about six hundred thousand dollars.

Central and Superior viaducts, the principal arteries for the flow of street traffic from the east side to the west side, have been so often discussed, that mention of them is scarcely necessary. The objections which have been raised against these bridges from time to time still hold good. Traffic is increasing and the bridges are ageing. The existence of draw spans still cause frequent and long delays to street traffic on account of passing vessels. The large center piers upon which the swing spans rest, are getting more objectionable from day to day on account of the obstacle they present to the ease of bringing the large modern vessels up the river. The draw spans in both bridges should be abolished. A satisfactory solution of this problem would cost probably three million dollars and it is to be hoped that something tangible in the high level bridge project will soon be brought about, linked, as it is, so closely to the comfort and safety of our citizens as well as to the development of the river navigation.

The Clark Avenue viaduct, which will afford an intermediate roadway across the Cuyahoga valley between Central viaduct and the Harvard-Denison bridge, has been started and will require eight hundred thousand dollars for its completion.

As our draw bridges are a menace and source of delay to street traffic on account of the river navigation, so our railway grade crossings are likewise a menace and source of delay due to the operation of the steam railways. It is to be regretted that so many of our streets are crossed by railway lines, but the growth of the city and the development of the railway systems have progressed so rapidly, the one, no doubt, largely dependent upon the other, that to-day many dangerous crossings exist. There are one hundred and twenty-six crossings where the grades of railway and streets should be separated. Of these, nineteen are complicated by existing street railway tracks and should receive first consideration. Based upon the proportion of cost established at the recent session of the State Legislature, namely, that railway companies should pay sixty-five per cent and the cities thirty-five per cent of the cost of separation of grades, it has been estimated that the

solution of the grade crossing problem as it exists to-day would cost the city at least eight million dollars.

In providing for the needs of a city probably the most essential thing is to furnish an adequate and pure water supply. Cleveland, among great cities, can be considered as most fortunate in having for its use so large a body of fresh water as Lake Erie. Probably no better water supply is to be had. The only requisite is that the water must be taken sufficiently far from the shore so that danger of contamination from sewage or other matter may be avoided. So important is regularity of the water supply that enormous damage might be done, should the supply be interrupted for even a day. Consequently as a matter of precaution, and so as to make available the use of the pumping capacity installed at the old Division Street pumping station, it has been thought wise to favor the extension of the old west side tunnel from the original intake crib to some point out in clear water in the vicinity of the new intake for the east side tunnel. This tunnel extension with shafts and cribs and additional pump is estimated to cost about one million two hundred thousand dollars. Ordinary pipe extensions projected for the water supply will amount to three hundred thousand dollars in cost. A new reservoir, east of the city, for which land has been obtained will cost about six hundred thousand dollars. This improvement will be eventually needed, as it makes possible the maintaining of an adequate pressure. Treatment of water by filtration has often been suggested as the only safe way to be sure of the purity of the water supply. Expert examination seems to indicate that the purity of the water supply is assured for some time to come, yet there are, no doubt, times when freshets in Cuyahoga River or other adverse conditions might bring contaminated water in the vicinity of the water intakes. Adequate filters built on modern lines would doubtless safeguard the city from an epidemic starting from any such source. One epidemic averted thereby would alone be worth the investment for such a filter system, even though it cost two million dollars.

The high pressure fire service with pumping stations, estimated to cost initially about five hundred and sixty thousand dollars, is thought by many to be one of the most needed improvements. The central portion of the city is becoming more and more crowded with buildings and it is impossible to estimate the loss to the city should a conflagration start in this section. Baltimore and San Francisco need only to be mentioned. Not only would the danger of a large conflagration be lessened through the installation of such a fire service, but the insurance rates would also be affected, thus bringing a speedy financial return to many of the property owners.

As a matter of necessity the sewerage system is almost equal to that of the water supply. In many respects the two must be considered together. The chief object in beginning the construction of the intercepting sewer system was to make possible the discharging of sewage into the lake at a point as far distant as possible from the water supply intake. The intercepting system as

planned is only a little more than half completed, and its full effect upon the water supply and upon the condition of the Cuyahoga River will not be attained until the remaining portion is constructed. The ten miles of Interceptor, still to be built, are estimated to cost about two million dollars.

Legislation which is under way providing for the paving and sewering of many miles of streets represents the ultimate expenditure of a large sum of money. New legislation is continually being introduced so that demand for this class of improvement is almost constant. At present there is contemplated the paving of over 200 streets, involving a cost of over two million six hundred thousand dollars, of which the city at large will be required to pay six hundred thousand. There is also contemplated the sewering of nearly one hundred streets, involving the payment, by the city, of over six hundred thousand dollars. The portion of the cost of both sewers and pavements, not paid by the city at large, is paid by the abutting property owners and is not included in the city's general debt.

The sewering of several extensive gullies along which flow streams now heavily contaminated with sewage, is not included in the above estimates. In this connection may be mentioned Burk Brook, Morgan Run, Kingsbury Run and Dugway Brook. The conditions along these streams are rapidly becoming serious ones, and, as a sanitary precaution and an economic undertaking, the construction of sewers along the stream beds should be given consideration, so that some policy could be adopted which would eventually establish the plan of procedure and provide the necessary funds for building the sewers. Every factory and commercial venture that is located along these streams adds to the contamination of their waters, and every dwelling built along the banks or in the neighborhood means one more family which must ultimately suffer from a nuisance. The cost involved in sewering these gullies would probably amount to one and one-half million dollars.

From the foregoing statements some idea may be formed of the enormous amount of work which has been suggested from various sources, the desirability of which few will question. The estimates total to a sum of thirty-five million, five hundred and twenty-five thousand dollars.

Fifteen years ago the city of Cleveland's total debt was $9,700,000, or about thirty dollars per inhabitant.

The assessed valuation of the real and personal property was $419 per inhabitant.

Ten years ago the total debt was $15,260,000, or about $40 per inhabitant, while the assessed valuation was $392.

Five years ago the total debt was $25,130,000. The per capita debt being about $56, while the valuation per inhabitant was $475.

To-day, basing estimates for comparison similarly to the foregoing and not upon the quadrennial appraisement now in progress, the total debt is $28,417,000, or about $54 per capita, while the valuation is about $502. In other words in fifteen years the

debt per inhabitant has increased from thirty to fifty-six dollars or about 87%, while the valuation assessed upon the property increased per capita from $419 to $502, or only about 20%.

This increase in the city's debt represents an equally large increase in the value of the city's property. Fifteen years ago the park system was undeveloped, no building had been begun at Warrensville, and the water supply was still being drawn through the old west side tunnel from a crib close to shore. In the interval, the mileage of pavements has increased from 100 to about 400, the mileage of sewers from 200 to over 500, and fourteen miles of the large intercepting sewer have been built. All of the grade crossing elimination work and by far the greater portion of the Cuyahoga River Improvements have been accomplished in this fifteen-year period. In short the debt increase must be regarded as being due to no other cause than the before mentioned demand for public work which our municipal conditions have made necessary.

Should now the improvements herein outlined be immediately attempted and the thirty-five millions added to the city's debt, it would more than double the latter, increasing it by 125%, and make a total per capita debt of about one hundred and twenty-seven dollars.

Just what the maximum allowable debt should be, is probably a question for financiers to establish and depends, no doubt, upon true valuation and whether a city is a growing one. The figures mentioned prove conclusively that in the last fifteen years the city debt has increased much more rapidly than the valuation, and shows incidentally the necessity of a true valuation and a radical reform in our taxation system. This may or may not be a serious condition but shows definitely how the times have changed in regard to the desire for public improvements. Shall we continue or should we retrench?

Obviously the many undertakings suggested could not all be begun at once. Even if money were provided the task would be so enormous that years would be required to plan and construct the work. Some of the projects may be required to wait many years, but some, on the other hand, cannot long be postponed, and it is one of the present problems to determine which is most essential and how it may be provided for. It is most difficult to decide what class of improvements is the most important, yet probably those projects which tend to save or prevent the loss of life and property should naturally receive first consideration. Certain hospitals we must have. The purity of our water supply must be assured, and for sanitary reasons sewers and pavements must be laid. All such improvements as are an aid to transportation, as pavements, bridges, and river improvements, are for economic reasons desirable and necessary.

The railway grade crossings should receive the earliest attention. From a standpoint of safety, the accidents which occur from time to time are the strongest argument and show the danger to which the traveling public is subject, in spite of care and safety

devices. From the standpoint of economy, the time lost to street traffic on account of annoying delays while trains are passing, and the expense and loss of time on the part of the railway companies, in operating the cars under numerous safety regulations, afford convincing reasons why the grades should be separated. As will be found in the case of obtaining a site for a high level bridge, the postponing of grade elimination work will add to the ultimate cost. Daily new buildings are being erected and commercial establishments located along the river valley, along the railway lines and the streets that cross them. Each building adds to the value of the land which may some day be needed by the city in grade elimination or bridge work or which may be so affected by the improvement, that the land would be entitled to consequential damages.

Whatever large projects are to be undertaken should have careful scrutiny, in order to determine their necessity or the good to be derived. Mere desirability, because of a certain limited longing or demand, ought not to be considered as sufficient cause for increasing the city debt.

Where bonds are to be sold for some project or structure, it would seem only proper that a method should be established whereby a sufficient fund would be accumulated to ultimately retire the bonds. The time of such retirement should be, as nearly as possible, the time when the life of the structure had ended. We, of the present, ought not to bear the expense alone of any structure to be used by future generations, nor should we compel those that come after to pay a debt incurred for something from which they can receive no benefit.

In order to control this almost insatiate demand for public improvements the best of judgment will be necessary so as to confine it in proper channels and to make possible wise discrimination among the many suggestions. Much study must be given the proper manner of providing the necessary funds so that they may be obtained only in such quantities and at such intervals that the financial system may not be too greatly strained.

The successful prosecution of the large engineering undertakings of to-day presents many interesting phases which appeal strongly to the engineers of the country. Many engineers will be called upon to offer the best that is in them to solve the numerous knotty problems involved. Much energy and endless supervision must be expended in planning and developing the numerous details, but we know that the American engineers will keep pace with the work and be found equal to meet every demand.

ADDRESS OF THE INCOMING PRESIDENT, J. W. FRAZIER, C. E.

Mr. Toastmaster, Gentlemen of the Cleveland Engineering Society and Guests:—

I consider it a great privilege to be President of The Cleveland Engineering Society and wish to thank you for the honor you have bestowed upon me this evening in electing me your President for the coming year. There are a number of members of this Society present tonight, whom you might have selected as your next President; good men, who are better qualified to hold the office and more able to conduct its affairs than the speaker, but I doubt if many have the interests of the Society more at heart and are more anxious for its success.

Last year your retiring President, Mr. Beahan, said in his talk that "Being President is not half so funny as it looks." Now, I cannot tell you whether this is the truth or not. I was expecting, as Vice-President, during the past year to have a chance to try myself out, but your retiring President, Mr. Hoffmann, has been so faithful in attending meetings and looking after the affairs of the Society, that I am obliged to start in "green."

I was on the Program Committee for two years, and each year took much interest in asking the in-coming President to make an address. If I had been on that Committee this year, your new President would have been seen and not heard.

Truly, gentlemen, I hate to talk in public. It reminds me of a story: A school teacher was giving her children a lesson in letter writing. She wrote on the board an advertisement something like this: "Wanted—A milliner to trim hats. Apply, Miss Smith, No. 10, East 6th St." "Now children, she said, I want you to take paper, pen and ink and answer this advertisement by writing a letter to Miss Smith." One little girl wrote:

"My dear Miss Smith: I see you advertise for a milliner. I hate to trim hats. Won't you try to get someone else? Please let me know at once. Yours truly, Katie Brown."

Now, that is how I feel about talking in public. However, as I am a Scotchman, it is up to me to make good.

Last Friday I called on Mr. Hoffmann at the City Hall, to see if I could find out what he intended to talk about. It was shortly after noon and I was informed that he had just gone out to lunch, but would return in a few minutes, as he was extremely busy preparing a paper for The Cleveland Engineering Society. They further stated that he had been working on this paper for three weeks, and during that time had been lunching on sandwiches and pie, taking only five minutes each noon. While we were talking, Mr. Hoffmann returned and admitted that he had been quite busy on his paper. He would give me no information

further than to say that it was a real fine paper, that he had just finished it, but found it wouldn't do and that he would have to start all over again.

Now gentlemen, if it took him three weeks to write a paper that wouldn't do, what kind of a talk is he going to give us this evening when he has had only three working days to prepare it?

I really got quite interested in "that paper which wouldn't do," made some inquiries as to why it wouldn't do, and confidentially got a tip that the Mayor had suppressed it.

It seems that the Mayor had sent for Mr. Hoffmann and advised him that during the present administration he would not be allowed to prepare, read or publish any paper without his approval. The paper Mr. Hoffmann had written was sent to the Mayor's office. From there it was turned over to the legal department for an opinion. Mr. Baker returned the document in short order, stating, that in his opinion it was entirely within the law for Mr. Hoffmann to prepare, read and publish his paper. He further stated that he had such explicit confidence in Mr. Hoffmann's ability that he would approve anything he wrote without even reading it.

The matter was also referred to the Street Railway Commissioner's office, and Mr. Dahl advised that in his opinion the reading, or publishing of the paper prepared by Mr. Hoffmann should be prohibited, as same was not in keeping with the Taylor plan. After a thorough investigation, he was led to believe that the discussion following the publication of this paper would be detrimental to the success of three cent fare. Under no conditions would he allow the reading or discussion of same on pay-enter cars.

The Building Inspector's office was also consulted and Mr. Marani advised the Mayor that in his opinion it would be an extremely wise thing for the city to allow this paper to be read, stating that he imagined there would be a great deal of hot air in it and that there might be some means of converting this into gas, and thereby solve the perplexing problem they now have up with The East Ohio Gas Company.

The Chairman of our Program Committee was advised of the situation. A hurried call was made for a meeting of the Committee, and that Committee which is the back-bone of this organization resolved that it was "*real darn mad.*" They also resolved to ask for an audience before the Mayor. Such a meeting was held, the result being that the entire matter was referred to arbitration.

Judge Taylor was selected as arbitrator. In referring to this honored Judge, I wish to repeat a quotation I read a few days ago, which I think could readily be applied to him:

"You've done some pretty decent things, without delay or fuss. And you are full of grit inside you, and that's what appeals to us."

We have him with us tonight and in due time he shall speak to you and render his decision. Whether or not Mr. Hoffmann talks to you tonight, depends entirely on this decision.

Another matter which I might call to your attention is, how did it happen that our good friend and ex-president, Dr. C. H. Benjamin is acting as Toastmaster this evening. I am informed that he wrote a letter to the Chairman of the Program Committee, stating that he was homesick and asked permission to preside at this meeting. Due pressure was brought upon Mr. Hoffmann, and after considerable wire pulling, it was voted that Mr. Benjamin should have charge of the meeting.

I understand that the Board of Directors advised the Program Committee that the present Membership Committee failed to organize and that during the past year no meetings were held. They were instructed to secure some talent for tonight, which would advise what changes should be made in the Membership Committee, to bring about more interest and obtain better results.

After some difficulty they secured Mr. Gobeille, one of our past Presidents, who will speak to us tonight, and I am confidentially advised that he will recommend an entire new set of patterns.

I also understand that there is another gentleman present who will talk to us this evening. His name does not appear on the program. He was either secured after the issue went to press, or else he is too modest to allow his name on print. I know that he is a good talker and before the evening is over, I feel sure that you will be as glad as I am that he is here.

Now gentlemen, what has the Cleveland Engineering Society done in the past, and what may be accomplished in the future?

In looking over the records, I find that the Society was organized in 1880; the first meeting being held in the office of the County Surveyor in the Court House on Seneca Street. The first officers were: Chas. Paine, President; A. Mordecai, Vice-President; Walter P. Rice, Corresponding Secretary; C. H. Burgess, Recording Secretary; C. A. Walter, Treasurer.

The membership at first was small, but it grew in number. The earliest official record was 184 in 1898. Our present membership is 328.

Mr. Hoffmann was the 24th President. During the past year we have had sixteen meetings, with an average attendance of 60. The first was the annual meeting in June and the second, at Detroit in August. The trip to Detroit was an enjoyable affair and I feel sure every one of the 70 people who made this trip would vote it a success.

The papers presented during the past year have been extremely interesting and instructive. Never before have we had better papers. A vote of thanks is due the Program Committee for the faithful manner in which it has performed its work.

We are now publishing our own Journal. The Publication Committee schemed out a plan for advertising and the revenue from this source alone, if not at present, soon will be sufficient to pay for the publication of the Journal.

In the inaugural address of our first President, Mr. Paine, he stated, "Let no member suppose that the club will run itself."

Now gentlemen that was true 30 years ago. It is true to-day and no club or society will flourish unless it has the help of each and every member. Although everyone may not be assigned some fixed duty to perform, let each member feel that he has something to do. He is a help to the club if he does nothing more than to attend its meetings. There is no reason why our membership should not be doubled. It would not be a difficult undertaking for each member to bring into the Society this coming year, one new member. There are a number of men in Cleveland who would join the Society if they were only asked. I think therefore that every one should feel himself a member of the Membership Committee, and do all he can to get in new members.

I should be pleased to see the Society take more interest in civic matters, especially those relating to engineering problems. Action has alrady been taken providing for the appointment of a standing committee, whose duty it will be to look after such affairs of the Society. This Committee will be a good advertisement for the Society. It will bring us to the attention of the public. I trust that this Committee, during the coming year, will take a special interest in its work and thereby show that the Society has an interest in the public welfare.

In closing, I wish to again thank you for the honor you have bestowed upon me this evening, and ask for your help and assistance in carrying on the work we may have to do, this coming year.

June, 1910. J. W. Frazier.

LOOKING FORWARD.

The new fiscal year sees our Society in the hands of a new administration.

Herewith are submitted "write-ups" from various officers and committees, which should receive the careful attention of every member of the Society.

For the benefit of the Corresponding Members and of those unable to attend meetings or to frequent the Club Rooms, thus perhaps having no opportunity to become acquainted with the new President and Secretary, whose duties and responsibilities make them more conspicuous than any others, the likenesses of these two men are presented.

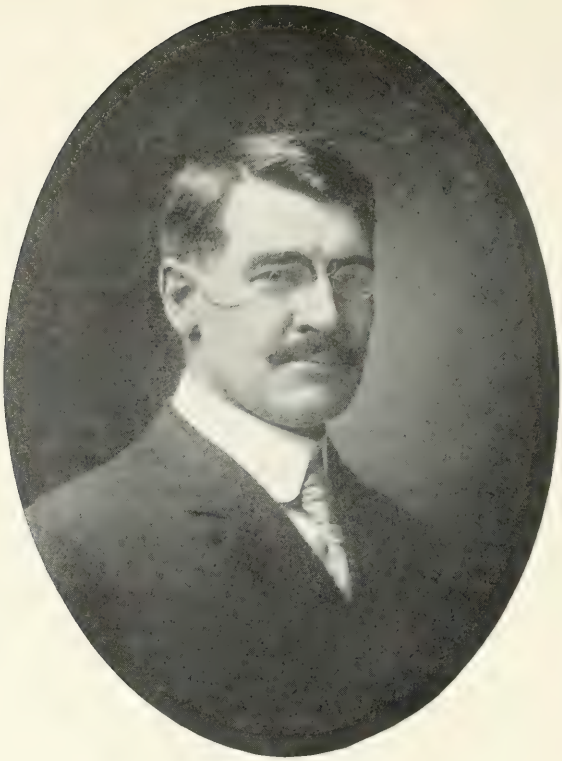
J. W. Frazier

OUR NEW PRESIDENT.

The head of our Society finds himself in an unusual predicament. He lacks sufficient material to furnish the words of admonition and exhortation expected by the Publication Committee for this issue of the Journal.

The other officers have very kindly "helped themselves to his dynamite," so to speak, and the Committeemen are prodding him, instead of vice versa. He is swept off his feet by the inertia of the swelling tide of activity, and is worrying about whether there will be a letting-up, or slowing down, at the end of the year so as to let him gracefully step out of the President's chair. Instead of driving the committees, he is concerned about whether they can stop when they want to. He did a fine job in appointing committees.

He pronounces his benediction and "Amen" and says "God Speed"—"Go ahead, Steamboat," and the Committeemen say, "We'll give you a run for the money." "We're off!"



F. W. Ballard

OUR NEW SECRETARY.

The "scribe" of our Society is a "Man with a Vision," as will be realized by all who read his exploitation of "Our Plans."

Those with proper religious training will be inadvertently reminded of the Scriptural passage: "Your old men shall dream dreams, and your young men shall see visions."

However that be, let all good members "limber up" and let each contribute his part so that the secretary's ideals may be realized. They are attainable, and practical, and he will surely "hold up his end"; for he has already demonstrated that he is also "a man with a hoe" (an implement not to be confused with a hammer).

"Go to it, kid!"

OUR PLANS.

In all undertakings, there must be something to work for and a reasonable hope of success, or it were better not to make a start. In accepting the position of Secretary of this Society, I did so with the understanding that it was the desire of the President and the Board of Management that the Society should be brought into a condition to more nearly realize the possibilities that are manifestly open before it, and that it should take its proper place in relation to technical work and the work of the community, as regards civic improvements.

We, as good citizens, owe to the community and to the city, the benefit of our skill and experience in handling technical and scientific problems, and where we, as individuals, have served private interests, even so can we collectively do much greater service to the city and to the community by uniting our resources and combining our qualifications in the discussion of public questions. We thus can not only produce opinions of great value as representing the composite skill, as it were, of all the best technical talent in the city, but we can also, by bringing about public discussions in which we participate, aid the citizens of Cleveland to become better informed regarding various matters of public interest.

Our membership is now only about three hundred and fifty. True, we have many of the best engineers and many of the leading manufacturers in our roster; but we know that the present number can be more than doubled, and this will be necessary before we can realize to the full all that is opening up before us. But we believe that this will be one of the results when it is fully understood just what the aims of the Society now are, and when it is seen and appreciated that our plans are not idle dreams, but are actually being put into effect, that the Society is taking its place in helping to solve the problems for the community, is disseminating general information on public questions, and is, at the same time, promoting the individual welfare of its members.

We have made arrangements for an assistant secretary who will devote all of his time to the work, and we believe that in the person of Mr. G. S. Black, who has been appointed to this position, we have very fortunately secured the services of a very enthusiastic, capable young man who will make the most of his opportunities and will make a record for himself, while, at the same time, advancing the interests of the Society. In addition to his other work, Mr. Black will devote considerable time to building up our list of advertisers in the Journal. He will also aid in carrying out our many plans for the development of the Society generally.

The House Committee are at work on the problem of securing better quarters for the Society. We contemplate a more convenient location for all our members, more floor space for the general use of our members in the way of lounging room, reading room and li-

brary, and private offices in which to transact the business of the Society; also, the use of a much larger auditorium than is now available for the large audiences which we hope to attract by our programs. We also expect to have the use of private dining rooms for committee meetings and the use of our members at the noon hour. Just what these plans are, cannot yet be announced.

The Publication Committee are doing excellent work in looking after the publication of the Journal and in securing suitable material of an interesting character which will, without doubt, make this publication a valuable feature in connection with the affairs of the Society.

The Program Committee have already had several meetings this year, and the excellent pograms which are being arranged will be a surprise to our members and will be a strong darwing card for the large number of visitors whom we expect to entertain and enlighten at our meetings, many of whom will doubtless become members.

The Membership Committee have already started the work of increasing our membership in a manner that is producing fine results, and which we expect will, in connection with our other plans for making the work of the Society interesting and beneficial, fully realize before the year is over our expectations of doubling the membership. It would obviously be improper, if not impossible, to outline all our plans at the present time. Our members, however, will, before the year is over, have an opportunity to see for themselves just what these plans are and how they work out. I wish to say, however, that we expect full co-operation of everyone with the work of the Membership Committee, so that when the end of the year arrives we will all share in the satisfaction of knowing that we have participated in the work of bringing about a most remarkable change from the old conditions.

Special Committees are being appointed by the President from our membership to work on various matters in connection with questions of general public interest and looking toward civic improvement. These committees have not all been appointed as yet. We hope, for your sake, that you will be fortunate enough to find yourself on one of these committees. The questions to be taken up by them will be made the subject of various programs during the coming year, and if you are a public-spirited citizen you will indeed feel fortunate in having an opportunity to lend your particular talent for the public good and the general welfare of the community in which you live.

F. W. Ballard, *Secretary.*

A WORD FROM THE TREASURER.

A new fiscal year has been entered upon and the Finance Committee has prepared a budget providing for as liberal expenditures on membership privileges offered as our resources permit. It is the intention to make the rooms, the meetings, in fact everything about the Society, just as attractive as our means will allow.

However, if the dues and other sources of revenue do not bring forth the required funds, a policy of retrenchment will be compulsory. The least any member of the Society can do is to pay his dues promptly, and failure to do so is an unjust imposition on the more loyal members who do meet their obligations without delay. Indifference and tardiness in such matters not only reflect unfavorably on the guilty ones and put the Society to the unnecessary expense of sending out repeated statements, but often cause embarrassment and even complaint from other members who are deprived of privileges which are rightfully theirs and which could easily be granted, were the dues paid at the commencement of each fiscal year.

Let everyone help the Treasurer and other officials, as well as the membership generally, by doing his share, and if, perchance, a member be found doing a little more than his share, the penalty will not be severe. (Verdict: "The reward of a thing well done is to have done it."—*Emerson.*) Therefore, PAY YOUR DUES PROMPTLY.

Our dues are payable June 1st, but up to date only 47% of the members have responded. In other well-regulated societies 60% of all dues are coming in during the first month of each fiscal year, and we should do as well. Brace up, Ye Delinquents, and avoid the BIG STICK.

E. E. Ranney, *Treasurer.*

THE PUBLICATION COMMITTEE.

With this issue of the Journal the Publication Committee begins its work for the ensuing year. It is the intention of the Committee to do all that it can to further the interests of the Society through the medium of the Journal. To do this and to do it successfully we must have the active co-operation of our members.

We need assistance especially in securing desirable material for publication. Among our members we have men who are actively engaged in practically every important manufacturing, engineering or architectural work that is undertaken in this vicinity. We feel sure that articles written upon such work would be of great interest to our membership. There are also many undertakings, while not extensive enough perhaps to form the subject of a paper to be presented before the Society, yet are of such an important and interesting nature as to warrant a short write-up at least. Such we will be very glad to receive. We exchange publications with a number of engineering societies and magazines, and to continue these relations it is necessary to publish articles that are of more than local interest. Our corresponding members and those members who are unable to attend the meetings, have no way of keeping in touch with the various activities of the Society, except through the columns of the Journal.

Our members can lend this committee much valuable assistance by helping to secure desirable advertising and incidentally secure a much needed source of income.

We would be very glad to devote a page in each issue of the Journal to personal news relating to members, regarding changes of address, business connections, etc.

Again we urge that every member who is in a position to do so, give us his assistance in making this year's publication of the Journal the most valuable yet gotten out by the Society.

Respectfully submitted,

PUBLICATION COMMITTEE,

GEO. F. BURROWS, *Chairman.*
E. E. RANNEY.
DAVID GAEHR.

THE MEMBERSHIP COMMITTEE.

The Membership Committee considers it a highly significant fact, and a call of duty, that *a membership of 328* for a Society like ours, thirty years old, counting amongst its members the best engineers in the community, which is noted for its many engineering establishments and famous industrial plants, *is entirely inadequate and incommensurate.*

Amongst our members are men of national and international reputation whose influence and support alone should be quite a

drawing card. We have many other privileges of membership to offer, especially the presentation of papers, which have been of very interesting and instructive character. Yet, for some reason, we have failed to attract many eligible men of good professional record, who are, as yet, unidentified with our organization, and it seems that we have not been unselfish enough to go out of our way and extend to them an invitation to join our Society. We need the inspiration of greater numbers, and the strength which comes from the union of many.

Every individual member of the Society is therefore urgently requested hereby to induce at least one desirable candidate to become a member.

The Committee feels that it is only asking each member to work for his own interests, which, collectively, means the interests of the Society.

A printed invitation blank has been prepared, suitable to hand out to prospective members, and setting forth the advantages of membership. Such blanks can be secured from the Secretary at the club rooms, together with application blanks, of which a new supply has been obtained.

Let every member volunteer to help in this work before he will be "drafted" into service. There will be no let up. No one should let another "steal his thunder."

Anyone finding it difficult to single out a desirable candidate amongst his acquaintances or friends can secure ample suggestions from the Chairman of the Membership Committee, or from the Secretary.

The Committee is determined to do its duty by such as are as yet without the benefits which membership in our Society offers, though it is by no means planning a "drag net campaign"; for, a professional Society like ours must scrutinize the character and standing of every candidate, lest the standard of its membership, which should always carry prestige, be lowered. Besides, approaching desirable candidates individually, manufacturers and business houses, affiliated with engineering industries, will be invited to have representatives in our membership as associate members. We should also increase the number of corresponding members.

With the proper interest and support of every member, to which the Membership Committee considers itself duly entitled, we hope to reach at least the 500 mark by the end of this fiscal year.

Respectfully submitted,

THE MEMBERSHIP COMMITTEE.

Chas. E. Adams	F. M. Kinsley
H. E. Hackenberg	C. F. Mullen
Ambrose Swasey	G. A. Peabody
E. S. Carman	A. B. Roberts
S. W. Emerson	R. E. Sheal
W. E. Dalgleish	G. E. Tower
T. S. Kemble	W. L. Westcott

David Gaehr, *Chairman*

THE PROGRAM COMMITTEE.

This committee is earnestly striving to do justice to the work assigned to it, so as to meet the approval of the Society.

It appreciates the importance of having the papers to be presented before the meetings during the coming year, of high character.

Special attention will also be given to having these papers of particular interest to residents of Cleveland, thereby creating a wider public interest in the Society, and incidentally aiding in the effort of the Society to be an active factor in the upbuilding of Cleveland.

The excursion which the Committee planned to Erie is the first visible result of its work in the new fiscal year. This enjoyable event is written up in another paper of this number of the Journal. The Committee, in behalf of the Society, sent letters to all the plants at Erie which accorded us a welcome reception and otherwise extended courtesies.

The visit of the Detroit Engineering Society to Cleveland September 24th in the form of an excursion, will afford us an opportunity to reciprocate the hospitality extended our Society on the occasion of its trip to Detroit last year.

As this goes to press we are still in anticipation of this pleasure, and our success as a host is to be reported later.

Our committee welcomes any suggestions which members of the Society care to offer regarding papers, excursions, etc., and will appreciate such an encouraging evidence of interest in its work.

Respectfully submitted,

GEO. B. DUSINBERRE, *Chairman*

H. A. BARREN
C. W. BROWN
H. B. DATES
W. O. HENDERER
H. M. LUCAS
J. E. A. MOORE
E. H. OWEN
F. A. PEASE

THE ANNUAL OUTING, AUGUST 24, 1910.

TRIP TO ERIE, PA.

A jovial company was assembled at the Grand Union Station at 7:30 on the morning of August 24th, and through the kindness of the Lake Shore Railroad Company, were provided a special coach on the tail end of the "Buffalo Special," for their trip to Erie. The ride was just long enough for the members of the party to become well acquainted, without getting too familiar, and was therefore enjoyed by every one.

On arriving at Erie, Mr. Umnitz, Secretary of the Chamber of Commerce, met the party at the station, escorted them to a special trolley car provided for their accommodation, and saw that everyone was made comfortable for a short trolley ride to the plant of the Ball Engine Company's works, where they were received very courteously and shown through the entire works, a modern and interesting plant, indeed.

The party next visited the Burke Electric Company's plant, which is located directly across the street from the Ball Engine Works. After being conducted through the different departments and shown the most interesting features of this large plant, the special car was held quite a while pending the round-up of three or four male members of the party who evidently were unable to say the parting word in one of the departments of this plant where a number of pretty girls were supposed to be busily engaged at their routine work. However, the complete party was finally gotten together and went from the Burke Electric plant to the Erie Forge Company's works.

It is worthy of note that this Erie company make sits own open-hearth steel, and converts the raw materials into finished heavy forgings, all in one plant. There are many new and unique methods employed here for getting out heavy forgings, which greatly interested our members, and after spending considerable time watching these processes, the party again boarded the special car and were taken to the car-stop nearest to the Edison plant.

On the way to the Edison plant from the trolley car several of the members became mixed up in an apple orchard and came near being arrested by the proprietor, but the difficulty was finally straightened out. From that time until the party again boarded the car bound for the Reed House to enjoy luncheon and a general social time, the party remained intact, and by its observance of rules of propriety and decorum commanded the respect of the Erie citizens.

In the afternoon the company divided, part of the members going to the Erie City Iron Works, and the others going to the Horseshoe Works and the Hammermill Paper Company; all subsequently reporting an interesting and instructive afternoon.

At 6:00 o'clock the party again united at Waldameer Park where an excellent chicken dinner was served by the Park management, and consumed by the party without leaving any byproducts; some dishes and cutlery, however, were saved. After dinner the different members of the company enjoyed themselves as they saw fit, visiting the various amusement places at the Park, and carrying on as they had "(n)ever since we were boys." At 9:30 they left the Park and proceeded to the boat landing at the foot of the main street, where the majority of the members boarded the boat and came back home on the water wagon. Those who came back this way, and it is said to their credit that the majority did, had a very enjoyable trip, as the night on the water was almost ideal, and all felt rested and ready for business in the morning, the rest, including the president, were committed to the care of the Fates and lost sight of.

This was undoubtedly one of the most interesting and instructive outings that the Society has ever taken, and those who did not participate in these pleasures as offered to members and friends have, in this instance, missed a rare treat.

W. O. H., *Official Reporter.*

PROGRESS REPORT OF THE COMMITTEE ON RIVERS AND HARBORS.

Cleveland, Ohio, August 26, 1910.

The Committee on Rivers and Harbors of our Society has memorialized the officers in charge of the engineering work for the United States Government at Cleveland in the matter of improving our inner harbor.

Legislation is now pending at Washington looking toward the improvement of the Cuyahoga River to the head of slack water.

A preliminary bill was introduced by the Hon. J. H. Cassidy, member of Congress from this district, and became a law at the last session.

The Committee is endeavoring through Col. John Millis, the resident government engineer, to have a complete and thorough survey made of the lower portion of the Cuyahoga River, as a basis for estimate of cost of such improvements, and to secure co-operation between the Government and private interests, if practicable. All this will take time. Now seems to be the opportune moment for a complete triangulation of the river, a full topographical map of same, its valley and confining bluffs, together with ample soundings and borings of the entire area available as a field in which to develop in time, if deemed advisable, such an inner harbor as the commerce of our growing city shall demand.

Respectfully submitted,

Willard Beahan, *Chairman,*
E. P. Roberts,
G. F. Burrows,
C. W. Comstock,
James A. Smith,
W. B. Hanlon.

THE LIBRARY COMMITTEE.

The work of the Librarian during the coming season will be along practically the same lines followed the past two years. The periodicals will be kept up to date and bound as soon as volumes are completed. An effort will be made to extend the exchange list. A few books will be purchased, but not many. In the present state of the Library Fund, it is thought best to proceed slowly in the purchase of books.

Since the last issue of the Journal, 29 Volumes of periodicals have been returned from the binder.

Gifts to the Library have been received as follows:

F. E. Bissell: Cornell Civil Engineer—1909-10.
University of Wisconsin: Bulletins Numbers 26, 38, 39, 42, 83, 197, 205, 216, 252, 264, 268, 318, 331, 337.
Metropolitan Sewerage Commission of New York: Report 1910.
U. S. Geological Survey: 94 Bulletins, 43 Water Supply Papers, 19 Professional Papers.
J. C. Beardsley: Duplicate Vols. of Journal of the Association of Engineering Societies.

The Library Committee hopes, with the co-operation of the Publication Committee, to establish a Book Review Department and an Exchange Department in the Journal.

The Book Reviews should be the means of securing gifts of new works from publishers and authors.

In the Exchange Department, attention should be called to valuable articles appearing in exchanges from other societies. It frequently happens that articles of value in various lines are published in these journals, which in the mass of publication, are not noted in the technical press. By making note of them in the Journal, it is hoped to make the library more useful to the members.

As soon as the new business management of the Society has the affairs of the other departments well in hand, the Library Committee proposes a vigorous campaign for a Library Endowment Fund. In the meantime, they wish to bring to the attention of the members, the great desirability of raising such a fund. The Cleveland Engineering Society is the logical body to support a technical library. It is properly one of the duties of the Society. Cleveland, as a manufacturing and engineering city, has need of such a library. No such collection of books exists nearer than New York City.

The time is rapidly approaching when the annual growth by addition of bound volumes of periodicals will make imperative a change in the arrangement of quarters and the employment of assistants. It is hoped that when that time arrives, the Library Committee will have at its disposal a Fund sufficient to meet all demands.

Library Committee—

Geo. H. Tinker, *Chairman and Librarian.*
Willard Beahan.
R. H. Fernald.

BOOK REVIEWS.

The Cupola Furnace. By Dr. Edward Kirk. Published by Henry Carey Baird & Co., of Philadelphia, and E. & F. N. Spon, Limited, of London. Price $3.50.

This is the third edition of this well-known work, contains 450 pages, 6x9 inches, and is bound in cloth. The Doctor has carefully reviewed and revised the various sections and brought them up to date. Some of the material which was of a general nature has been rewritten so as to occupy less space, thus making room for much new matter. The entire work has been reset and is carefully printed and fully illustrated. The changes comprise between one and two hundred pages. Some of the new things included are recent tuyere design, notes concerning new cupolas, the use of oil torch for lighting, and modern handling appliances for taking care of stock and charging the cupola.

Metallography Applied to Siderurgic Products. By Humbert Savoia, C. E., translated by R. G. Corbet and published by E. & F. Spon of London, and Spon & Chamberlain of New York City. Price $2.00.

This book contains 180 pages, 4x6¼ inches, bound in semi-flexible buckram, and is devoted to the study of iron and its products by the microscope. The author made a careful study of the subject in Europe, and later operated laboratories in Italy. He has studied all the literature bearing on the microscope and its work, and experimented with the various reagents and methods. The chapters devoted to the apparatus are brief, but clear. The microscope described is one which is much used abroad, and the other apparatus is standard. The micrographic illustrations and the explanations accompanying them are excellent. The different products occurring in iron and steel are defined and illustrated, and the distinction between the different compounds are carefully brought out. Naturally, the author pre-supposes some knowledge of chemistry and metallurgy. The work will serve as an excellent introduction to the subject for anyone interested in metallurgy who desires to delve into this new science or see what the microscope can do for the control of metallurgical products.

PERSONALS.

Mr. E. E. Boalt is convalescent at the Huron Hospital.

* * *

Mr. C. P. Howard is in Maine locating an extension of the Bangor & Aristook Railroad.

* * *

Mr. F. E. Bissell has returned to Cleveland after a year's absence in Kentucky as Locating Engineer of the Ohio, Kentucky & Atlantic Railroad.

* * *

Mr. J. H. Fox, Past Treasurer of the Society, has severed his connection with the firm of Frazier & Fox and is now located at Pittsburg, Pa., as Chief Engineer of the Pittsburg Plate Glass Co.

* * *

Mr. A. A. Honsberg has just returned from a trip to Europe where he attended the convention of the American Society of Mechanical Engineers and the Institute of Mechanical Engineers at Birmingham and London.

* * *

Capt. J. C. Beardsley, Past Secretary of the Society, is on an extended trip through the West in the interests of the Thompson Meter Company. He addressed the convention of Superintendents of Water Works at Waterloo, Ia., September 20th, on the subject of "Saving Water by Use of Meters."

* * *

Mr. Ambrose Swasey of the Warner & Swasey Company, since attending the joint meeting of the American Society of Mechanical Engineers and the Institute of Mechanical Engineers, in England, is continuing eastward on his second journey around the world; the first journey in 1902-3 being in the opposite direction. According to his itinerary he sails this month from Naples, Italy, on his trip to the Orient.

* * *

Mr. W. R. Warner of the Warner & Swasey Company has just returned after a two months' trip in Europe. While abroad he attended the joint meeting of the American Society of Mechanical Engineers and the Institute of Mechanical Engineers held in London and Birmingham. After the convention he visited Tourraine and spent some time studying the French Chateaux, and from there made a trip through Switzerland.

PRACTICAL POINTS.

Brief and to the point: In a certain University the curriculum of the Mechanical Engineering course comprises a course in "Engine Handling," intending to give the students a training along practical lines. Students are given opportunity to fire boilers, run engines, set valves, etc.

In an examination the question was asked: "If you were to go into a boiler room and find no water showing in the gauges, the safety valve blowing off with a deafening noise, the fire roaring in the furnace, and no chance to use the surplus steam, what would you do?"

A conscientious student, whose paper was signed with the usual declaration, "I have neither given nor received aid in this examination", answered briefly: "I'd run like hell!"

Extract from F. C. Osborn's Poem entitled "The Engineer," presented in response to a toast at the Annual Banquet of the Civil Engineers' Club of Cleveland, March 29, 1900, and equally applicable to the present renewed activity in the Cleveland Engineering Society.

But coming now to serious facts
(If such can come from poetry quacks)
What class of men in recent years
Has helped the world like engineers?

Look at the works they've carried out—
Think of the things they're now about,
And you'll agree beyond a doubt
We're better with them than without.

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OF

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First Meeting of the Society in the New Fiscal Year, Evening of September 27, 1910, Chamber of Commerce Auditorium

Introductory Remarks by President J. W. Frazier.

The object of this meeting tonight is to outline to you our plans for the coming year, to make a few announcements and hear a paper and discussion on "Grade Crossing Elimination."

We deem it proper to tell you what we propose to do, before we listen to the paper of the evening.

Our Society was founded in 1880 by a small body of men, and it has gradually increased in number until, at the present time, it has an enrollment of about 325. According to our Constitution, the object of the Society is the professional improvement of its members, the encouragement of social intercourse among them and the advancement of engineering science. We believe the Society, in years gone by, has conscientiously lived up to the Constitution. We do not, for a moment, want to criticise the good work that has been done in the past, but the present administration feels that the time has come when this organization should take a more prominent part in civic affairs.

With the growth of our now great city, problems of great magnitude are before us, many of which are *purely of an engineering nature*. It is these problems which we propose to take up, and as an organization, we want to lend our aid in boosting our great city, which is now sixth in size, as regards population, and keep on boosting; aiming to make it second to none, as regards its civic improvements.

That great body of men, the Cleveland Chamber of Commerce, has been a great help to Cleveland's advancement. The business methods employed by its present administration, the painstaking care in which the committees are appointed, and the manner of carrying on the work, is receiving commendation from all sides. They are accomplishing things that no organization of its kind has ever done before. They make themselves felt. We want to follow their example. We cannot be as far reaching in the scope of work, but we do not want to travel on different roads. We prefer, Mr. Secretary of the Cleveland Chamber of Commerce, to work with you.

There is one grade of membership in our Society that is limited to ten members; that is Honorary Membership. Being limited to so few, you can readily realize that it is not very often that a President has the privilege of presenting a name for Honorary Membership. This privilege, however, is mine tonight. On the thirteenth of this month, a petition, signed by fourteen members, was presented to the Executive Board, asking that Honorary Membership be bestowed on a very prominent and well-known man of this community. The Executive Board was unanimous in its recommendation of its approval. The Society, on the same evening, received the recommendation from the Executive Board, and by unanimous vote elected General James Barnett an Honorary Member. You will note the portrait (painting) of General Barnett adorns the walls of this room. This man is generally spoken of as "Cleveland's good old man." In accordance with our Constitution, it was necessary to receive an acceptance from him of this appointment. The speaker called at his residence the latter part of last week, and he spoke very kind words regarding this Society. It was his earnest wish that it continue to prosper in the future as it has done in the past. He further stated that it was so long since he has been able to attend any of the meetings of the Society that he would not have been surprised if the Society, in place of electing him as an Honorary Member, would have passed a resolution asking him to resign. He wished me to state that he accepts the honor with many thanks.

As regards civic work, we have appointed a "Rivers and Harbors Committee." This committee has already done good work in connection with the proposed survey of the Cuyahoga river. It made a report and recommendations to the local government engineer and had an interview with him. Later, this engineer made a report to his superiors and, as his recommendations were not in opposition to our committee's report, we feel free to say, our work was not in vain.

Another important committee will be one on "Building Code." The code, although carefully prepared, is in need of revision from time to time. We believe this organization, through its committee, can be of valuable service to the city administration and council, in advising what changes should be made.

Another committee will be one on "Water Supply and Sewage Disposal." The question of "Crib Extension, Filtration Plant and Sewage Disposal" are all engineering problems and a technical explanation will certainly make the subject better understood.

We also expect to announce, in a few days, a committee on "Franchises and Municipal Ownership;" another on "Bridges and Grade Crossing Elimination."

A year or more ago, the Mayor appointed a committee or Board to investigate and report on the high level bridge question. Some four or five organizations, including the Chamber of Commerce, were represented on that Board, and although the bridge problem is entirely an engineering problem, the Engineering So-

General James Barnett.
Honorary Member.

ciety was not asked to be represented on the Board. The Mayor's attention was called to this, and he apologized, stating that he had forgotten that there was such an organization in Cleveland. It is true that we are not centrally located; our quarters being on Huron road and East Ninth street. We believe, however, that this is in greater Cleveland. We trust that if the

present Mayor should, of a necessity, require the appointment of a committee on any engineering subject, he will not forget that there is an Engineering Society in Cleveland, a Society that is always ready to help solve problems of public interest.

I take this opportunity to advise all those present tonight, that we have this day signed a lease for new quarters, on the fourth floor of the Chamber of Commerce building, and you will find us in our new location as soon as the rooms can be put into shape for occupancy. We expect to have many advantages in this new location, which is more central and more accessible to all car lines. Many of our members are enrolled as members of the Chamber of Commerce, and this means that no small percentage of our members will enjoy the privileges of the Chamber of Commerce lunch room. Committees can meet in our own rooms at noon and carry on business while at the lunch table, and much valuable time can thereby be saved to Committeemen. The change was made on the recommendation of the Executive Board, and it is to be hoped that this will prove a wise move, and that it will be the means of a very large increase in our membership.

We feel that we now have more to offer our members than we have ever offered before. We have employed an assistant secretary, in the person of Mr. G. S. Black, who devotes all of his time to the work, and this alone should be a help in building up our organization. We have set a mark this year to double our membership. We do not want to lower our standing by taking in anybody and everybody, but we feel that there are many eligible men—good men, too, who are residents of Cleveland, but are not connected with our Society. We invite all such men to affiliate themselves with us. We need you in order to accomplish what we have set out to do. Cleveland as a city, with its 560,663 population, is ahead of Pittsburg with its 530,000 odd population, but Cleveland with its 325 members in the Engineering Society is away behind Pittsburg with its 900 members. Let us, as members of this Society, keep in mind not only "Greater Cleveland," but the "Greater Engineering Society."

Now, gentlemen, you have heard what we are aiming to do this coming year. This meeting is the first of a series of meetings, at which matters of public interest will be discussed. There perhaps is no public improvement that is talked of more at the present time than the "Railway Grade Crossing Elimination." This is no easy undertaking. To maintain traffic in the streets as well as on the railroads, and to provide switching facilities to various industries means carefully laid out plans. We know of no one who is better informed on the history of Cleveland's grade crossing elimination and how the new work is to be carried on, than the Chief Engineer of our city. I have the pleasure, gentlemen, of introducing Mr. Hoffmann, who will now talk to you on "Railway Grade Crossing Elimination."

Railway Grade Crossing Elimination in Cleveland

By Robert Hoffmann, C. E.

General Conditions in Cleveland.

Fifty or sixty years ago, when the railway companies were first laying their tracks within the limits of Cleveland, little concern was felt about crossings, at the city streets, becoming a serious problem. Cleveland's population was then less than forty thousand, and its area less than three square miles. Today, in a city with a population of over half a million, and an area of forty-six square miles, the situation presents a totally different aspect. Where originally one track crossed a street with only a few trains per day, there may now be found four and five tracks, each perhaps with as many trains per hour. The street traffic has increased with the population; so, what was once an unimportant suburban crossing has become a busy city street with a daily ceaseless stream of foot passengers, vehicles and street cars. Could

Existing Grade Crossing at Union Ave. and Pennsylvania R. R.

this enormous growth of railway traffic and the rapid increase of the city's population have been foreseen, the relative grades of streets and tracks would, no doubt, have been so established as to prevent nearly all grade crossings; but, as railroad building has been the development of a growth peculiar in itself, considered both financially and scientifically, we must accept the so-called grade crossing problem as one of today, and not lay any blame upon our predecessors on account of lack of foresight.

That railroad crossings at grade of streets should be abolished, seems well established and projects to that effect are being undertaken in nearly every important city in the country. That locally there is a demand for grade eliminations was shown by the recent vote in favor of issuing two million dollars worth of bonds to enable the city to continue in its work in that respect. The strongest argument in favor of abolishing railway grade crossings in cities is, of course, the possibility of removing the great danger to life which their presence causes. In spite of all the safety devices and precautions adopted in recent years, every now and then a serious accident takes place, causing a loss of life, which the separation of grades might have prevented. No other argument ought to be needed, as it seems a basic principle, that city streets should, with reasonable care, be safe to use and not present any condition forming a menace to life.

Secondarily, the elimination of grade crossings is desirable for reasons of economy. Calculations based on time lost by passing trains holding back street traffic can show results of enormous amounts. It is questionable to just what extent the saving in time in this regard could be realized on—that there must be some economy, however, is quite evident. Even without any direct financial return, the possibility of street traffic being allowed to continue without friction and irksome delays, makes in itself a strong argument in favor of eliminating railway grade crossings. Where no grade crossings are encountered, there must also be a great saving in expense to the railway companies, for the reason that they are able to dispense with safety gates, guards and the slowing down of trains. Whether the saving due to the last mentioned item is a net saving or not, depends upon the amount which the railway company must invest in order to make such saving possible. There can be no doubt, however, that in addition to the horror of taking life, the liability for the payment of damages—due to accidents—must appeal to the railway companies as an argument sufficient in itself to make separations of railway and street grades desirable and necessary.

Granting that such separation is mutually desirable, the question arises in what proportion should a municipality and railway company divide the expense. In some cities, the railway companies have been forced to assume the entire expense, but in most cases the municipality assumes from one quarter to three quarters of the cost, the tendency of the times apparently being to force the railway company to pay the larger proportion. The railways and the cities are certainly interdependent, the business of one has

Eliminated Grade Crossing at Broadway and Pennsylvania R. R.

Clark Ave. and C., C., C. & St. L. Ry., Showing How Grade Crossing was Eliminated.

made possible the growth of the other. The evil of grade crossings is a matter which neither the municipality nor the railway companies could have foreseen, being the result of the gradual growth of conditions, to the existence of which both have contributed. It seems only just, therefore, that both should pay a proper proportion of the expense, which will vary depending upon the benefits derived. Should, for instance, the railway company, under a grade elimination agreement, be allowed extra concessions, such as additional tracks, additional right of way, or have made possible a change in grade of alignment of special value to the company, it seems only right that the railway company should pay accordingly. On the other hand, should no special advantage accrue, an equal division of the cost would seem more just. When abolishing existing railway grade crossings, it seems eminently proper that the municipality should, in any event, pay something towards such cost, the amount depending somewhat upon local conditions, and upon state law requirements, but probably this amount should never be over 50 per cent. Another conclusion which can be drawn, with equal force, is, that whenever new railways are built, they should either be so located that no grade crossings are established, or, should crossings be permitted, the municipality ought to have the power to order their elimination at the expense of the railway company as soon as traffic conditions make the same desirable.

History of Local Developments in Grade Separation.

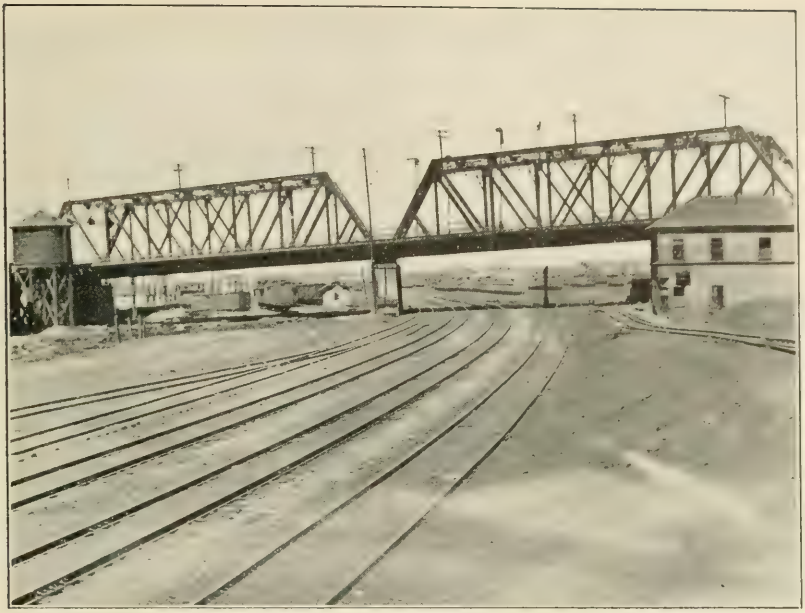
Locally, grade crossing elimination work began about 14 years ago, when East 55th street, then called Willson avenue, was elevated and carried over the tracks of the N. Y. C. & St. L. Ry. This crossing had long been looked upon as a dangerous one, the railway tracks crossing at the foot of a steep approach, and being further complicated by an existing street railway track. In making this improvement, the railway company built the south approach and the portion of the bridge over the railway tracks, while the city built the rest, including the north approach. An amount of ten thousand dollars was contributed by the street railway company. This is the only case in the city where a street railway company has made any direct contribution towards the expense of eliminating a railway grade crossing.

In 1902 and 1903, a more active campaign was begun by the city and all the railway companies were called upon to present plans for grade eliminations according to law. Since that time, the various crossings have been eliminated as fast as the plans and terms could be mutually agreed upon, and as the city could procure the necessary funds to pay its portion of the cost. The following work has been accomplished:

Pennsylvania crossings at Broadway, East 93d street, Warner road, Harvard avenue, Seager avenue and Kinsman road.

Erie railroad at East 55th street.

L. S. & M. S. R. R. at Detroit avenue.



Kinsman Road Bridge Over Pennsylvania R. R., Showing How Grade Crossing was Eliminated.

Eliminated Grade Crossing at Cornell Road and N. Y. C. & St. L. Ry.

N. Y. C. & St. L. Ry. at Detroit avenue, West 98th street and West 96th street.

B. & O. R. R. at Clark avenue.

C., C., C. & St. L. R. R. at Clark avenue.

W. & L. E. R. R. at Jefferson avenue and Harvard avenue.

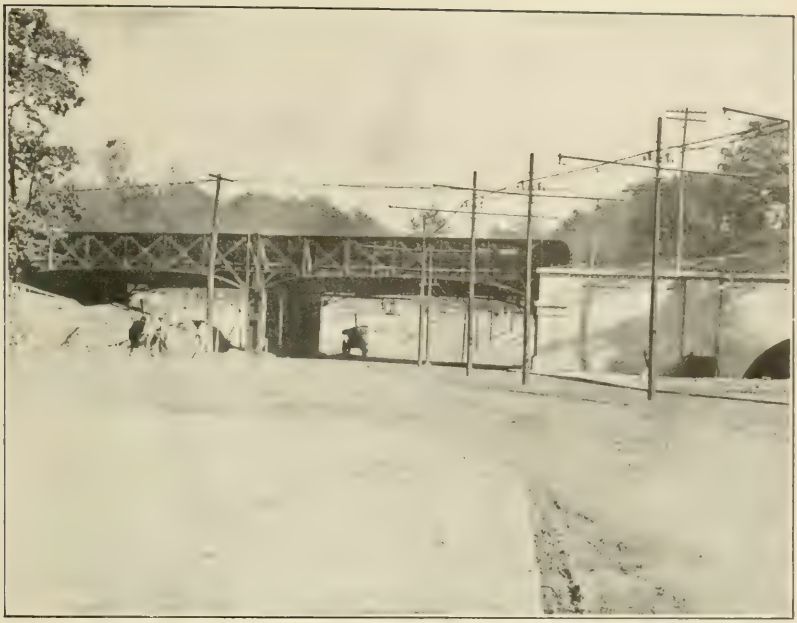
At present, there are in course of elimination, along the line of the N. Y. C. & St. L. R. R., crossings at Euclid avenue, Mayfield road, Cornell road, Adelbert road, Woodhill road, East 105th street, Quincy avenue and West 25th street. Incidental to these last crossing elimination, existing railway bridges across Cedar avenue, East Boulevard and Fairmount road, are being rebuilt to suit the changed grade of the railway tracks. With the exception of West 25th street, the crossings now being taken care of along the N. Y. C. & St. L. R. R. are being abolished at the expense of the railway company alone, the company having paid into the city treasury the proportion required by law for the city to assume. The railway company obtained, through a condition of the grade elimination legislation, grants to lay two additional tracks across the streets mentioned, which, no doubt, compensated it for the extra cost assumed.

Many more railway grade crossings in Cleveland are still to be eliminated. Those where the highway is used for street railway traffic must be considered the most dangerous, and consequently the most urgent for early treatment. As in many cases, the railway grade must be raised or depressed, as well as the highway grade changed, it is often not practical to abolish one crossing at a time, but requires the consideration of a group of streets. This is the reason, as all engineers will readily appreciate, why certain grade crossings generally acknowledged as the most desirable to eliminate, such as Euclid avenue and Lorain avenue, have not been provided for heretofore.

In order to raise the Pennsylvania tracks 17 feet, as contemplated at Euclid avenue, it will be necessary to begin the approach grade from the north in the vicinity of St. Clair avenue, and from the south at Central avenue. To do otherwise would introduce an approach grade far steeper than the railway traffic could be expected to operate upon, and would also temporarily bring the track grade at the neighboring streets at an elevation lower than the ultimate one, necessitating thereby temporary bridges and unfinished approach grades. Temporary work of this kind is always undesirable, as improvements cannot be made to fit the finished street grade and the interruption to traffic, due to construction work, must take place a second time when raising the tracks to their final elevation. Similarly at Lorain avenue, some ten or twelve of the neighboring streets must be taken into consideration, should the railway tracks be lowered as planned, so that the crossings may be reasonably provided for, and that the railway may be properly operated.

Along the line of the Pennsylvania Company there remain, within the city limits, 29 crossings to be treated:

Along the L. S. & M. S. R. R., thirteen.



Cedar Ave. and N. Y. C. & St. L. Ry. Bridge Under Construction.

West Twenty-Fifth Street and N. Y. C. & St. L. Ry. Retaining Walls for Approach Under Construction Along Property Line.

Along the Erie R. R., seventeen.
Along the N. Y. C. & St. L. R. R., forty-two.
Along the C., C., C. & St. L. R. R., twelve.
Along the B. & O. R. R., eight.
Along the W. & L. E. R. R., twenty-three.
Along the Newburgh & South Shore R. R., two,

making a total of 146. Some of these do not demand immediate attention and some can possibly be so combined that one crossing may answer for two or three of the streets. At 26 of these crossings, there are street railway tracks, and they are, therefore, the most important and ought to receive the first consideration, but, as stated, they involve the treatment of neighboring crossings, so that at least as many more must be abolished in order to provide for those at street railway tracks.

Just in what order the remaining work will progress cannot be finally established at this time, as it depends largely upon the co-operation of the railway companies and the speed with which the agreements relating to the work can be obtained by the city. The bond issue of $2,000,000, recently voted upon, is to provide money for certain crossings only, as stipulated in a council resolution, and will probably be sufficient to pay the city's portion of those crossings most necessary to abolish.

Grade Crossing Law.

Should the railway companies refuse to co-operate, or should no agreement regarding plans and division of cost be reached, the statute fixes a method of procedure.

The grade crossing law provides that municipalities may raise or lower the grade of any street, or may order the raising or lowering of railway tracks in order to separate grade whenever the council or other legal board of legislation may declare the same necessary.

Municipalities may also, for such purpose, relocate and vacate streets where such action is declared necessary. The council or board of legislation may order, by ordinance, that railway companies co-operate with the engineer of the municipality and submit plans and specifications within three months, or longer if mutually agreed upon, specifying street grades, railway grades, kinds of structures and method of erecting, also, whether supports or abutments are to be located in streets. No change, however, in the railway tracks shall be made that exceeds the ruling grade of the railway.

In the event that the railway company fails to co-operate or, in case the plans and agreements are not mutually approved, the municipal corporation may submit the matter to the Court of Common Pleas. An opportunity is then given by the court for either the railway company or the municipality to submit plans for grade elimination. The court may then pass on plans, order changes or refuse plans. The court also has the power to enforce the work.

The division of cost is provided for by statute, having formerly

been equally divided by the municipality and the railway company, but being changed, at the last session of the legislature, so that the railway company must now assume 65 per cent of the cost, and the municipality 35 per cent.

Provision is also made for the payment of damages to owners of property affected by reason of change in street grades. Power to appropriate land necessary is likewise given.

The municipality must pass a resolution or ordinance setting forth its intention to do the work and establish the manner of paying damages. Notice of such intention is served upon property owners supposed to be affected, thus giving them time to file claims for damages as provided for by law.

Grades of streets changed must also be re-established and notice of such re-establishing served. Generally the notices regarding the intention to eliminate the grade crossing and change the grade of the streets can be combined in one. The grade crossing law also establishes the clearance of bridges over railway tracks as 21 feet, but provides that by mutual agreement or court order, this clearance can be reduced, but cannot be made less than 16 feet 3 inches.

The maintenance of the structure is established, in that the statute provides that railway companies shall maintain all bridges used in carrying the railway over the highway, and the municipality shall maintain all bridges used for carrying the highway over the railway tracks, together with the street approaches.

Bonds may be issued to defray the municipality's portion of the cost, but such bonds may not be sold at less than par, and shall not bear interest to exceed 4 per cent. Taxes may be levied to provide for payment of bonds and interest, and also to provide for necessary maintenance and repair. Street railway companies may be made to pay not to exceed one-half of the municipality's share of the cost.

Construction Work.

In the foregoing, the general history of the railway grade elimination movement in Cleveland has been given, together with an abstract of the law authorizing and providing for the work. What will possibly be of more interest to engineers is a discussion of the engineering questions involved or the structural details and difficulties encountered. However, to enter into this phase of the question at all elaborately would extend this paper far beyond the time allotted to it.

The engineer, in grade crossing abolishment, has often an exceedingly complicated problem in the execution, even when only a single crossing is being treated, but the problem becomes many times greater when an attempt is made to prepare plans for the elimination of the crossings of an entire city like Cleveland, traversed as it is by several railroads. These railroads cross each other and provision must be made for connecting lines and also for the separation of grades at certain railway crossings. These conditions, together with ruling grades of the railways, are basic

things to be considered. Add to these the maintenance of railway traffic, as well as highway traffic, the encountering and relocating of numerous underground improvements, such as sewer, water pipes, gas pipes and electric conduits, the question of drainage and beauty of architecture, and there results a problem to solve, which requires the best ability of both railway and municipal engineers.

In making the general plan for grade elimination along the line of any railway, one of the first questions to be considered is, whether the tracks should be raised or lowered. Discussion of this topic is perhaps forced on account of the interest taken by the public. Many citizens fear that either the one treatment or the other may result to their disadvantage, possibly due to smoke, the making of more noise, the possible development of undesired manufacturing property, or, on the other hand, rendering such development impossible. Judging from local experience, it is doubtful whether one could determine which plan is the better.

From the railway point of view, there is little opportunity for any general discussion of the question of raising or lowering tracks, it being almost wholly a problem which must be decided in each case, and not a matter of policy. A railway company would naturally adopt that plan, which, all things considered, would prove the most economical, due consideration being given to structural difficulties, drainage, development of business and grade betterments. This might cause either the lowering or raising of the tracks, depending upon the things involved.

From the city's standpoint, the economy of first cost has some weight, but much less so the economy of railway operation. The noise and smoke from such operation do, however, seriously affect the public interest and it is quite generally agreed that all steps are warranted which tend to reduce these two evils to a minimum. Many seem to feel that this can best be done by sinking the railway tracks as low as possible. There are certain locations, where perhaps a railway track at any elevation is unsightly, and where lowering the grade for that reason alone would be desirable. Railroads, however, are built and operated to do business and not merely to refrain from becoming a nuisance, so that any plan of treatment must keep in mind all the practical sides of the problem, and no hard and fast rule that tracks should be either raised or depressed should ever be drawn. The extent of changes required in the city streets on account of any proposed plans will always present some of the strongest arguments in determining whether tracks should be raised or lowered. The greater the change, the greater the damage and the greater the annoyance resulting to the public. It is to the interest of both the railway company and the city that the grade of the tracks be kept to a minimum rate and probably more can at present be accomplished in that one respect towards reducing the evils of noise and smoke than in any other manner. The noise that disturbs the most is not the rumbling of trains, but the puffing of the engines on a steep grade, and the whistling and ringing of bells at street crossings, all of

which can be greatly reduced by reducing the rate of grade and abolishing grade crossings.

With the beginning of construction work, the traffic along both the railway and highway becomes involved and presents for solution one of the most troublesome problems of grade crossing eliminations. Provision must be made for both kinds of traffic. The railway company's trains must be kept in operation, carrying passengers and freight, even though the tracks are being raised or lowered. Great credit must be given the railway engineers in so scheming and manipulating their work that traffic may proceed and yet have room and opportunity for using steam shovels, for laying new tracks, providing for drainage and erecting new bridges. This often involves a considerable expense which is not always manifest when making estimated costs for work of this kind.

No less important is the consideration of the highway traffic. Imagine the condition, should the sixty or seventy thousand people daily passing over the Pennsylvania tracks at Euclid avenue, be forced to take some other route during the period required to eliminate this crossing. Evidently the work must be done in such manner that traffic on both the railway and highway can be maintained. At the best, the traffic, though not broken, must be subject to interference, business in the vicinity of elimination work may be affected and as a consequence much criticism heaped upon those directing the work with accusations of neglect, slowness and even incompetency. Some of the criticism may be merited, as it is quite natural that the progress of the construction work should appeal more strongly to those in charge than the ease and comfort of the people who wish to pass alongside and over the work while it is in progress. Engineers will appreciate the difficulty of always making work of this kind run smoothly, where, in addition to the work of the contractor and the maintaining of traffic, there must also be considered the property of a street railway company, the pipes of the gas companies, the wires and conduits of two telephone companies and an electric light company, and in many cases the city sewers and water pipes. It seems almost impossible to make the work of the various interests follow logically without annoying delays. Where possible, a considerable outlay is warranted in providing a temporary roadway at some other location, and this has frequently been done. In many cases such a temporary detour is not feasible and the public must needs be patient and realize that the interruption to traffic is necessary and in a good cause.

Experience and usage have established certain limits and prescribed certain conditions which have been adopted in carrying out the details of the Cleveland work. Solidity has been striven for and designs made so as to insure a low cost of maintenance. Railway bridges have been specified to have solid floors of steel and concrete with ballasted tracks. Highway bridges have been built so as to permit the laying of a brick or stone paved roadway. Supports at the curb lines have been permitted at a number of

places where the railway bridge carried the tracks over the highway. This was done in order to avoid the excessive depth of girders required in certain long spans, making possible a saving in expense as well as producing a more pleasing appearance by establishing a better relation between depth of girder and the clearance above the roadway; otherwise the roadways have been kept clear, no supports at the center of the roadway having been allowed.

Clearances over highways have been varied from a minimum of 13 feet to 14 feet 6 inches, where existing or proposed street railway tracks made the greater clearance necessary. This clearance has been thought too small by the engineer of maintenance of way of the local street railway company, who claims that 15 feet should be the minimum. The suburban cars would be better accommodated with a 15-foot clearance, as would also some of the construction cars and appliances, used by the street railway company. It is quite probable that this clearance will be increased to 15 feet in the future work.

Wherever possible, clearances of highway bridges over railway tracks have been fixed at 21 feet, the maximum required by law, but along the line of the N. Y. C. & St. L. R. R., on account of highway approach complications, the minimum of 16 feet and 3 inches was adopted.

The approach grades vary with local conditions and it is endeavored not to introduce heavier grades than those in use in the vicinity of the bridge. In some locations, local grades must be exceeded, but, in general, it is attempted to keep within a maximum grade of 4 per cent. In a few cases, 5 per cent grades were used and in two cases 6 per cent, on account of local conditions making a less grade inadvisable.

In general, surface improvements on the approaches, such as paving and sidewalks, are relaid with material similar to that existing before the change in grade. The old material is used to some extent, but most of it is new. In cases where the new grade is at a rate of 4 per cent or greater, no matter what material has formerly been used, it has been the custom in repaving to use block stone. It so happens that nearly all of the crossing approaches so far treated in Cleveland, under grade crossing proceedings, are paved with Medina block stone.

Nearly all of the bridge abutments and retaining walls in the grade elimination work have been built of concrete. This material has certainly shown itself to be an economical one and of great adaptability for such use. It can hardly be claimed that the masonry structures so far built in this connection are very beautiful, and they seldom present as pleasing an appearance as is possible with block stone masonry. The unsightly crazing, cracking and discoloring that concrete is subject to has taken place in nearly all cases. It must be conceded, however, that progress is being made in concrete finishing and that some of the more recent work now in progress shows a decided improvement in this respect.

Not many of the grade crossing bridges are so located or have settings that invite or make possible what might be termed artistic work. Nearly all such bridges have been made strikingly utilitarian. Probably more attention should be paid to the obtaining of artistic lines in bridges, abutments and retaining walls. It costs but little, if any, more to build walls with panels and copings properly proportioned, or to design girders and trusses with proper regard to a pleasing and artistic outline. Public work, no doubt, should be made so as to set an example in construction and should, therefore, be so designed that it is beautiful to look upon and create an impression of solidity and security. More attention in this regard was given the plans for the bridges along the line

KINSMAN ROAD AND PENNSYLVANIA R. R. BRIDGE, SHOWING ABUTTING PROPERTY LEFT AT GRADE OF OLD STREET NOW SELDOM USED FOR TRAFFIC.

of the N. Y. C. & St. L. Ry., through the eastern portion of the city, than was done to those of most of the other grade elimination structures. Proximity to residence streets and parkways naturally invited such treatment and there seems little reason why it should not always be adopted. It could certainly do no harm and would cost but little more to place sightly structures even in manufacturing districts, where they might possibly tend to develop the aesthetic side of those of us who pass nearly all our days among shops, warehouses and railway tracks.

Property Damages.

One of the least agreeable duties in connection with grade crossing elimination work, viewed from the engineer's standpoint,

is the adjustment of damage claims. This is because there is so much opportunity for argument, complaints and bickering wholly foreign to an engineer's desire. Locally, less of this work is now cared for in the engineering office of the city than formerly, it having been found more satisfactory to have the law department adjust the claims. It has been found desirable to employ a claim adjuster who devotes all of his time to this phase of the work. From time to time, it is also found necessary to have competent appraisers appointed who pass upon the various cases for which damage is claimed.

In nearly every crossing, in which the grades are separated, it becomes necessary to change the grade of the highway. Buildings have probably been constructed on the abutting land or it may have been otherwise improved, all with reference to the grade of the highway, as originally established. Where the level of the street is changed to conform with the plans of the crossing elimination, it frequently leaves the improved property either so much higher or lower than the new grade, as to affect the property value detrimentally. It is to properly adjust any such loss in value that damage claims are considered and adjusted.

As mentioned in the paragraph referring to the legal proceedings used in eliminating grade crossings, notices are served upon property owners, calling their attention to the proposed work and to the contemplated change in the grade of the street, affording thereby an opportunity to file a claim for damages should any exist.

Damages are usually adjusted after the work is completed, the time of such adjustment being fixed by council resolution, which is referred to in the notice served upon property owners.

There is a great opportunity for difference in judgment in fixing the amount of damage which a given piece of property is entitled to, by reason of change of grade. In some cases, nearly the entire value is destroyed, as it may involve a relatively great expense to raise or lower buildings, fill or excavate lots or otherwise readjust matters to suit the new grade.

It is a difficult question to approach in a scientific manner, as scarcely two cases are alike. Even if two similar cases arise for adjustment, it would be found that the claimants held different views, so that, in the end, damage adjustment becomes largely a matter of negotiation and arbitration.

Several items like loss in business during construction, or loss in value, due to traffic being so diverted that it no longer passes in front of or near a piece of property, are not considered in law as valid claims for damage allowance. There must be a change in grade of the street upon which the property abuts, or else some other direct physical change due to the improvement in order to entitle property to any consideration for damage allowance.

The general effect of a so-called grade crossing improvement is ordinarily favorable upon the land in its vicinity, after time has been given for the changed conditions to adjust themselves. No account is taken of this general benefit as an offset to damage

claims. Should there be some special benefit by reason of the improvement, it would be allowable to consider it, in fact it indirectly must be, if damages are correctly fixed, as they theoretically should always amount to the difference in value of the property before and after the improvement is made.

Difficulty is frequently encountered in securing land needed by reason of relocating streets, building approaches or changing the line of railway tracks. This sometimes causes exasperating delays particularly irksome to the engineer, as it so impedes the progress of construction work. An attempt is always made to secure such additional land at a price mutually acceptable, but

West Sixty-First Street, Showing How Street was Lowered on Account of Clark Ave. and C., C., C. & St. L. Ry. Grade Elimination.

should no agreement be possible, resort is had to the courts and the property appropriated. I am pleased to state that to date only in a few instances has it been necessary to bring suit for the acquiring of land or in settlement of damage claims, and that in each such case the position of the city has been practically sustained.

Estimated Cost.

The ability of the city to abolish grade crossings depends principally upon its power to provide the necessary funds. No structural difficulties, at all hard to surmount, have appeared, and the power under the law to proceed with the work seems to be ade-

quate. Lack of funds alone can block progress. No issue of bonds for grade crossing elimination purposes has been at all seriously opposed. and as the proposed issue of $2,000,000 was ratified at the recent election by a two-thirds vote, it can be deduced that public sentiment is favorable. With these things in view, it seems in place to attempt making a rough estimate of the cost involved in eliminating all remaining crossings, as the city will, no doubt, be soon called upon to pass upon further expenditures for such purposes.

When certain damage claims now pending have been adjusted, the city will have expended for grade crossing purposes about $1,070,000. Add to this an estimated cost of $175,000, as the city's share of abolishing the West 25th street crossing, and there results a total of $1,245,000, paid as the city's portion of the cost of eliminating 16 crossings. This makes an average cost of about $78,200 per crossing. This average cost takes into consideration certain crossings that were abandoned, the streets being connected with others in the vicinity and a combined crossing at the railway tracks provided. Each such street is counted as an eliminated crossing. The work so far done has involved complicated, expensive cases, and also some that were reasonably cheap and simple. The estimate given can, therefore, be used as a fair average.

Changing this average cost to suit the rate of 35 per cent, which now represents the city's portion of the cost of grade crossing work, the cost for future work per crossing would be $54,740. This would yield a total sum for the cost of the 146 remaining crossings of nearly $8,000,000. The proposed Pennsylvania crossings will probably cost the city a greater than the average rate, as the expense of raising the extensive track system of the railway company is relatively great. Other railway crossings would show a much smaller average cost, notably so, where the abandoning of certain street crossings will be possible. In order to obtain a proper conception of the magnitude of the work, there must be added to the city's expense that of the railway company, which by law is made nearly twice as great. Railways, when eliminating grade crossings, also frequently take the opportunity to make certain betterments, the cost of which is not shared by the city, so that it is safe to say the total sum to be expended in connection with grade elimination, based upon present conditions, will amount to over $24,000,000.

The expense of establishing grade crossings must be weighed in the balance with that proposed for other improvements. It would be neither practical nor reasonable to so hasten the one improvement that others would suffer. Both the city and railway companies are limited as to the amount of work they can undertake, and as to the indebtedness they may incur.

There can be no doubt, however, that progress in removing the dangerous death traps at railway crossings should be continuous, making possible thereby the conducting of a busy world without delay along paths of security and safety.

Discussion

A. J. Himes, C. E.:

There are two ideas which I would like to place before you this evening. The first has to do with the spirit with which we are to approach the great engineering problems now prominently before us.

Those great social movements, which have been most successful, have had their origin in a deep seated conviction of the public need. The spirit which causes the successful citizen to leave his comfortable home, his family and friends, and go forth to battle as a soldier for his country's welfare, is a spirit that is not born of lust for gold. Such a spirit cannot be aroused by the hope of financial gain, nor by thirst for fame and glory. Yet that spirit is the one that makes and unmakes nations, one that builds and destroys cities, and if we seek the highest success in developing a city pre-eminently adapted to the well-being of its citizens, it is the spirit in which we much approach these great works which are to tax our strength, our patience, our every resource.

If in tearing up the streets of our city, in obstructing the use of our most important thoroughfares and causing inconveniences and delay to thousands of our busy citizens, our first and absorbing thought is that we are saving lives and building wisely for the future safety and convenience of our people, then our task will be light and our work successful. If, on the other hand, it is to be a scramble for selfish advantage, a continued struggle to see who will profit most by the changes that must be made, then the way will be dark and long and dreary, and the final realization of our plans and hopes may be long deferred.

The second idea which I would present, pertains to a study of the problem itself. In this study we should look beyond little things, taking the broadest view permitted by the possibilities of the case. With this in mind I would call attention to some failures to grapple successfully with great economic problems.

In New York City, before the electrification of the elevated railways, these were taxed to their utmost limit, and the profits from their operation were so generous that for many years the owners rested content and made no effort to increase their transportation facilities. But with the march of events, electrification was finally accomplished and the first annual report thereafter showed an increase of travel that was astounding. Then a subway was projected and people fondly hoped the day would come when they could ride comfortably the full length of Manhattan Island. But alas for the hopes of man. The subway was completed and the last condition is worse than the first. Every transportation line on the Island is a maelstrom of humanity and to one unaccustomed to navigate its currents, the dangers of Niagara's rapids are not more real. Now the cause of this unhappy condition is the unreasoning and instinctive trait of humanity

that leads us to huddle together in crowds as long as, by any amount of squeezing, room can be made for one more. Everyone in New York wants to do business in the region of the City Hall. Engineering genius has pandered to their wishes and we have seen the development of the great office building. There was a time when the New York Life building was remarkable for its size and beauty. At a later date, the Park Row building enjoyed the distinction of having the greatest number of stories. Now it is the Singer building, and the limit of engineering possibilities has not been reached. Every morning and every night the people surge in and out of these great buildings in torrents. The entrance of every building is a vortex whose dangers are more real than one is apt to think.

Now the lesson is this. Engineers have been providing the remedy instead of removing the cause of the difficulty. It is a case that calls for the exercise of governmental authority. People must be governed. They will grumble more or less, but in the end, when the reason for an order has been demonstrated, they do not complain. There should be a limit to the size of buildings, a restriction to conform to the reasonably practicable limits of transportation and, with a proper adjustment so made, the transportation problem would be solved.

The application of this lesson to the present case lies in the continued practice of opening new grade crossings across the railways. We are planning to remedy an evil, but not to remove the cause. We should by all means eliminate the grade crossings, but where is the end to be? Cleveland, one million in 1920. Its limits will reach out towards Lorain and Willoughby and where is to be the end of our work?

One more illustration. It has always been the custom in American cities to spend large sums in paving streets and to then immediately permit the paving to be torn to pieces for the installation of gas mains, conduits, railways and other so-called improvements. The result is an immense economic loss. In the larger cities, it is now common to build sewers and water mains in advance of the pavement, and we are told that the public service corporations, which are permitted to tear up the pavement, will restore it at their own expense. There is too much juggling with expenses. We should be able to discriminate between direct and indirect taxation. We strive to have the rates for gas and street car fare fixed according to their cost, and, if we succeed, then we are certainly vitally concerned in the cost of construction. The cost of elimination of grade crossings is not different. You may get the legislature to enact that the railroads shall bear 50 per cent of the cost, or 35 per cent, or the whole cost. In the end, the patrons of the roads must bear the cost. The day of speculative railroading has passed away and the law will always permit a fair return upon the investment. The railroads have no great treasury, from which gold can be extracted by legislative enactment. The possible expenditures are limited by the earnings, and the earnings are derived from the traffic. With this in mind,

it must be clear that the future welfare of the people demands that there be a stop to the perpetual elimination of grade crossings. The source of the evil must be removed in order that the expensive remedy may be avoided. In bettering the conditions within the city at the present time, we must look ahead and avoid similar future expenditures, the date of which will be hastened by that great urban growth, for which we so fondly hope.

We have made great improvements in the past. We have greater ones before us. The cost of these works is fabulous. We must think well and plan wisely that the wealth intrusted to our care be not frittered away in costly mistakes or careless management.

W. M. Ray, C. E.:

While it is apparent from Mr. Hoffmann's statement that there are only some six or eight grade crossings within the city limits which are charged against the Baltimore & Ohio Railroad Company, it is not generally known that the city has just completed the elimination of the grade crossing of Clark avenue S. W., with the new classification yards of this company, at a cost of about $215,000. In this improvement, the railroad company participated under City Ordinance No. 6424, passed March 11, 1907. The bridge is not a high level structure, but crosses the yard tracks with a clearance of 21 feet above top of rails, and will form a link in the series of embankments and bridges which are proposed to carry this thoroughfare over the various railroads and the river to a connection with Clark avenue S. E.

The bridge was originally projected to comprise seven pony truss spans, about 100 feet in length, but plans were later changed to include an additional span over a proposed street, paralleling the right of way of this company on its south side, thus making the length of the completed structure 780 feet.

At present, the bridge is connected with the grade of the flats by an approach embankment on each end and will probably carry very little traffic until the improvement is completed across the valley.

Mr. F. E. Bissell, C. E.:—

The great danger attendant to grade crossings is a condition that could not be foreseen in the early days of railroad building and is the result of the rapid growth and development of the country.

Every president, general manager and superintendent of a railroad, yes, even the engine men and the section men would be only too happy to have all grade crossings on the line eliminated.

The clash between the municipal authorities and the railroad management, over the elimination of grade crossings, is not due to any difference of opinion as to the desirability of such elimination, but to a question of method and finance.

A railroad, hundreds of miles in length, passing through

many cities and towns, must consider the demands of any municipality not as an isolated case, but as one of the many cases existing along its line.

The municipal authorities seldom look beyond their corporate limits and fail to appreciate that other towns and cities are making similar demands and to grant them all is beyond the financial ability of any railroad.

The railroads are willing and do eliminate many grade crossings of their own volition, whenever they can do so without extraordinary expense. The state of Iowa has no legislation on the subject, nor does there seem to be any demand for any action; yet, up to June 30, 1908, the railroads had eliminated 751 grade crossings. Some of the states are regulating the matter by legislative enactment. In Vermont, each railroad is required to eliminate one grade crossing each year for every 80 miles of road. In Connecticut, it is one grade crossing each year for each 60 miles of road. In Massachusetts and Virginia, a state commission orders what grade crossings shall be eliminated and also approves the method by which it shall be done.

Not all grade crossings are, by any means, the voluntary creation of the railroads. The locating engineer reaches a town with the survey and all the male inhabitants thereof come out to meet him and show him where to locate the line. In all probability, they have offered free right of way to the railroad as an inducement to run through their town and not through some rival place. So, to please the people and to get through the town with as little friction as possible, the engineer locates the line as the people desire, which, in many cases, is down some back street, which helps the town in the cost of the right of way. The street is duly vacated for that purpose by a unanimous vote of the city fathers and with the consent and approval of everybody. The town having railroad facilities, grows, develops and expands. The early citizens pass away and a new generation coming on suddenly jumps up and asks the railroad what it is doing there, occupying a street, invading the people's rights, and demand forthwith track elevation and grade crossing elimination and all at the expense of the offending (?) road.

Some twenty odd years ago, a town, in the southwest, was laid out just as the railroad was being completed. They made Main street 100 feet wide, but placed 50 feet of its width on the north side of the right of way and 50 feet on the south side, and North and South Main street has become the big business street. The town has now some 12,000 inhabitants and already they are beginning to inquire why the railroad is occupying the center of their magnificent main thoroughfare.

A railroad projected a line through a town in Pennsylvania, eliminating all grade crossings, but the citizens protested, and said, come in on the ground floor where we can do business with you; and the railroad at considerable expense changed its line so it could pass through at grade. But the time is fast approaching when that town will demand that the road elevate its tracks and

pay all the cost of such change even though the condition is the result of the expressed wish of the citizens.

There is nearly always a needless amount of friction as to what methods shall be followed in eliminating a grade crossing; not generally between the engineer of the municipality and the engineers of the railroads, but it comes from those who are not engineers and who do not understand the details of the problem. The methods to be employed in each case should be treated purely and simply as an engineering problem.

If the decision of the Massachusetts State Commission in the matter of grade crossing elimination at New Bedford were made the basis of all negotiations, it would be much better for all concerned. In that case the commission insisted that the cost be kept down to the lowest figures compatible with standard railroad practice and a fair substitution for what both the railroad and the city then enjoyed, and decreed, that the railroad should be elevated and pass over the streets on structures which shall be proportioned and constructed in accordance with the general specifications of the railroad company for railroad bridges.

The greatest objections to plans proposed by the railroad come from those who, after an examination of the plans, still have no conception of exactly what they mean.

I was called upon to examine and report on an undergrade crossing on a country road, where the railroad company's plans showed an undercrossing giving 20 feet clear width and 12½ feet clear height for the highway. The citizens on looking at the plans declared they could not drive through such a small opening; it was an impossibility—yet, only 1,000 feet distant, on the same highway, there was a wagon bridge, 80 feet long, with only 14 feet clear width and 11 feet clear height, through which they had been driving for over 20 years.

At another time I prepared a plan, which called for supports at the curb line of the street. There was a vigorous protest; the railroad wanted to blockade the street; business could not be done on account of those supports. In a cursory examination of the streets of that city, there was found to be at the curb line, or within 2½ feet of it, the following: Trolley poles, telegraph poles, telephone poles, electric light poles, fire alarm poles, flag poles and barber poles, besides hydrants, street lamps, awning supports, mail boxes, waste paper boxes, police call boxes, street signs, business signs, hitching posts, horse blocks and shade trees.

My experience is that the smaller the town, the greater the objection to supports at the curb line. New York has supports at the curb line.

In Chicago you find supports at the curb line and also in center of the street. In Philadelphia all crossings on the Philadelphia & Reading Railroad, 32 in all, covering some five miles of track elevation, have posts at the curb line and many have also a support in the center of the street.

Not all objections to a railroad company's plans are honest; entirely too much opposition is for political effect.

A county commissioner objected to a 4 per cent grade in a subway, when the average traffic was only 15 teams per day, saying it was an outrage to require the farmer to haul over such a grade, and yet there was an 8 per cent grade in that same highway, not 3,000 feet away, and they were at that time expending the taxpayers' money in building a road with 15 per cent grade.

On another occasion, the engineer of a new line presented plans to the county commissioners to eliminate some ten or more highway crossings. Action on them was delayed on one pretext, and another, until the engineer inquired of one of the commissioners how soon any action would be taken. In reply, the commissioner said he did not really know, the plans looked all right and, no doubt, if it was properly appreciated, they would all be approved. At the same time the newspapers published an article saying that the railroad's plans had not been allowed, because the board had the interests of the people at heart, and that they could be relied upon to see that the rights of the county were upheld. I am glad to be able to say that those plans were finally approved, without being "appreciated."

Many plans are criticized and objected to, because they are not considered beautiful or artistic.

I think many such objections are not well founded, but are based on wrong ideas as to what is truly beautiful and artistic. It must be remembered that, in by far the greater number of cases, artistic design is greatly hindered by location and legal requirements, and that the beauty of proportion is not attainable, while the structural forms of material with which the engineer has to work in bridge building, are not so elastic and manageable as to lend themselves readily to artistic design.

It might be well to recall a few of the laws and maxims given out on the subject of design. "When the simple form and purpose of a structure becomes so disguised that the mind cannot grasp them, then the effect will be to create dissatisfaction, which is contrary to all ideas of beauty."

"The general form should never disguise the purpose of the structure, but should aid in impressing the mind with visible strength and proper adaptation to the purpose."

"Ornamentation should not change the general character of the structure to such an extent as to hide the underlying principles of construction." This law is so frequently violated that we are often at a loss whether or not to believe what we see.

"In any design any violation of engineering principles is also a violation of good taste from an artistic point of view."

"A form which admits of no explanation or which is a mere caprice cannot be beautiful."

Covering frames with concrete or boards painted to imitate stone arches, or horizontal girders blended with arch construction, all violate the foregoing laws. The last instance is like putting the dome of a Turkish Mosque on a Gothic Cathedral.

The character of any structure must not be contradicted by any of its parts.

Finally, technical miracles have no claim to beauty.

B. R. Leffler also took part in the discussion, bearing principally on the grade crossings along the L. S. & M. S. Ry., with which he is actively connected.

Grinding Machinery

Paper Read Before the Society by C. H. Norton, Dec. 7, 1909.

A consideration of this subject would be incomplete without a brief reference to the early practice of cylindrical grinding, and the mention of a few of the men, who have played an important part in it.

It is probable that lathes with grinding wheels, mounted on their carriages, have been used in various parts of the world for more than 60 years.

I remember well such a lathe, made by the Phoenix Iron Works Company, of Hartford. This was at the works of the Seth Thomas Clock Company. It was fitted with a grinding head, mounted on the carriage, for grinding some small, high speed spindles, about 5/8 inch diameter and 10 inches long. I review with interest my experience in trying to grind these spindles, in 1867 or '68, and recollect how certain I was as to the impossibility of obtaining round and straight work by grinding. This was also the verdict of all concerned, so that the grinding of these spindles was abandoned.

It is easy, in the light of experience, to understand why we failed then, but there are thousands of mechanics today, who are repeating for themselves that experiment of 32 years ago, and are judging the merits of cylindrical grinding from the result of the same methods. Those who are following the same trail would do well to reflect that, after some 60 years of such trials, the art of grinding by the use of such improvised lathes has not advanced one point beyond the early experiences.

The lathe was early used to grind rolls for metal and paper, and it is most interesting to note that mechanics had regarded it as a machine for producing truly cylindrical work, until its use as a grinding machine revealed to them its imperfections. Profiting by this experience, while grinding rolls, Mr. J. Morton Poole, in 1867, invented and constructed his double-wheel roll grinding machine. Instead of mounting wheels directly on the carriage, he mounted them on a swinging frame which, in turn, was mounted on the carriage. The wheels operated simultaneously on both sides of the roll. As their axes were moved nearer together, the work was ground smaller, and vice versa. Inasmuch as this frame, on which the wheels were mounted, could swing freely without changing the distance between their axes, the roll could be ground with uniform diameter regardless of the ordinary error of the carriage ways. We may, for the sake of illustration, think of these wheels as being mounted in the two points of a pair of calipers, being placed astride the roll with one point of the

caliper on one side, and one on the other, and the caliper suspended from above. It is plain that we are really calipering the roll and grinding it at the same time true to this caliper; using, as it were, a caliper with cutting points to create the size that we are calipering. This machine has been successful in grinding accurately rolls for various purposes, and is still used largely for this work. It was a brilliant invention, for obtaining accurate rolls with a machine having inaccurate carriage ways, brought out at a time when the mechanical world knew not how to produce accurate and permanently straight guiding ways, and it deserves special emphasis in the history of cylindrical grinding.

The art of scraping to master straight edges was not well understood in this country at the time of Mr. Poole's invention, but at the present time has so far advanced that we are enabled to produce machines with guiding ways so accurately and of such a permanent nature, as to make it perfectly feasible and commercially practical to grind to the same degree of accuracy with a single wheel as the Morton Poole machine did in its time with the double wheel on the swinging frame. The double-wheel machine must, of necessity, be limited in its application, owing to the fact that the wheels are on both sides of the work.

To cover the entire field of cylindrical grinding, a machine must be as accessible and as quickly operated as the lathe. Therefore, there can be but one grinding wheel and that must be on the back, so that the work may be easily inserted between centers and removed from the front of the machine.

Mr. Ambrose Webster, of Waltham, Massachusetts, well-known in years gone by from his connection with watch machinery, in about 1860 constructed and used several plain cylindrical grinding machines having a wheel carriage, or slide, moving along the back, and a swivel table at the front, on which are mounted the head and foot-stock. They were very carefully constructed and really fine machines, and have been in use many years in the watch industry. Mr. Webster, several years before his death, told me the story of his experience and the development of these machines. He had tried in vain to grind with a wheel mounted on a lathe carriage, and the design of these machines was the result of his experience. Mr. Webster was a very fine mechanic and produced very fine work with these machines. I think he might safely be called the pioneer of accurate, commercial grinding, and the first inventor of the plain cylindrical grinding machine with a traveling wheel and fixed work table, tapers being obtained by swiveling the table to preserve alignment of the centers.

About 27 years later, Mr. Abram Landis brought out a plain and universal machine, with a wheel traveling at the back and having a swiveling work table, which type is still made by the Landis Tool Company.

Some time just previous to the Civil War, Mr. Forbush, a machinist of Lynn, Massachusetts, conceived of a universal grinding machine with sliding work table, swiveling wheel slide, and

swiveling headstock. He, with the help of his associates, worked out a design, and had practically completed the patterns when the call came from President Lincoln for volunteers. Excitement ran high, and Mr. Forbush, with his associates, put their work away, locked the door of the little shop, and marched to the front to fight for the preservation of the Union. Mr. Forbush served through the War, and, after his return to Lynn, opened his little shop and completed his universal grinding machine, on which, although containing all the movements of the modern universal grinding machine, he was unable to grind work successfully, so that, after many fruitless attempts, he abandoned it and allowed it to accumulate rust and dust. It was in this condition when I accidentally came upon it, some time in 1888. Like so many others, he had expected to succeed with a very small outlay for iron and with cheap construction. This error, coupled with a lack of knowledge of grinding wheels, and the trouble that accompanies all efforts to grind cylindrical work without a copious supply of water, or lubricant, made this early universal grinding machine a failure.

The introduction of the Brown & Sharpe universal grinding machine, about 1878, with its moving work table and fixed wheel, opened the way to the development of grinding machines as distinct from grinding lathes—machines that could be constructed to have and maintain perfectly straight lines, and at the same time have heavy and powerful grinding wheels, thereby enabling rapid as well as accurate work, with a single wheel, which admits of convenience and universal application. The entire world is indebted to Mr. J. R. Brown, the inventor of the Brown & Sharpe universal grinding machine, for much of the progress that has been made in securing accuracy and reduced cost of construction in a long list of industries. Few people realize the extent to which the cylindrical grinding machine has affected their lives. For illustration, the now common article of food, shredded wheat, would never have been possible without the cylindrical grinding machine. This machine produces accuracy which, before its use, was impossible, and without which the machinery for manufacturing this food would be impractical. Sewing machines, typewriters, shoe machinery, watch tools, and a long list of industries received new impetus with the introduction of the Brown & Sharpe universal grinding machine. It was not my privilege to know Mr. Brown. He died before I became interested in grinding machines, but I remember seeing him, many years ago, when he visited the works where I was employed. I was then a mere lad with greasy hands and face, unnoticed by him, but I remember that I looked upon him with admiration as the maker of refined tools. As a leader in mechanical refinement, he was far ahead of his time.

Some years after his death, it was my privilege to be entrusted with the further development of his invention, and, though I never met him, I have, through the study of his machine and his methods, come to understand something of this

thought and the message he left for us. This, as I understand it, is—"Let everything you produce and the method by which you produce it represent exact truth." When your methods are truthful, you will secure your products at low cost, and have the satisfaction of doing honest work. The effort to get something for nothing costs us all very much in the end, whether we break into our neighbor's house and steal, or whether we attempt to secure our product by breaking our way with makeshift tools and makeshift methods. It is a common trait of human nature to maintain that the short and easy cut is the least expensive, and that through some mystical process we can secure less expensive work by avoiding thoroughness. Those who are not willing to be thorough in their methods, had best not attempt to use modern cylindrical grinding machines, but those who are discerning will realize large economies by the use of these tools. For instance, the reasoning of practically every railroad man today, as regards car wheels, is that refinement is not necessary. Yet the last two years have witnessed the grinding to perfection of many thousands of chilled car wheels, which had formerly developed flat spots in a few months' service when used without grinding. Since grinding was employed, out of many thousands but few, if any, have been returned for re-grinding, because no flat spots have developed. I mention this to turn your thought from the original conception of grinding, which regarded it as of no value, except for delicate and so-called precision work.

There is yet a great deal of misunderstanding as to the field of cylindrical grinding. Some still believe that it is only a refinement, entailing extra cost. On the contrary, it is a method of machining round work that always reduces the cost, when intelligently applied, and which can give us better work than the lathe, and if we so desire, we can obtain work that is "refined," denoting a degree of accuracy still short of perfection. Furthermore, there is still prevalent a misapprehension in regard to what commercial grinding means, and to what extent one can expect perfection, from a really good machine. There appears to be no fixed standard of perfection; no fixed standard of finish. Every man has his own uncertain, variable standard, and it seems that some are expecting absolute perfection from the grinding machine.

One of the most important facts for us to get clear in our minds is that in the practical and commercial world all perfection is relative, especially in cylindrical grinding. If the product of the grinding machine is nearer perfection than the product of the lathe, and at the same time costs us less, then the grinding machine has proved its right to the field.

The lathe was never intended for a polishing and buffing machine, nor for a lapping machine. We have used its centers and spindle to revolve work upon, while we filed and polished it, or lapped it, but there was nothing about the lathe which contributed in any way to the quality of the filing or lapping. That was a matter of hand work entirely. Therefore, when we wish to judge as to the merits of grinding, we must draw comparison

with turning alone, not with filing and lapping. If we can, with the grinding machine, take the finishing cut formerly taken in the lathe, reducing the time of the operation, and at the same time produce a better surface and nearer cylindrical perfection, than is possible in lathe work, then we are warranted in substituting the grinding machine for the lathe, on finishing cuts, or sizing operations.

If, occasionally, we require an absolutely perfect cylinder, we must lap it in addition to turning or grinding. A properly constructed grinding machine will do this perfectly. We should not, however, expect perfectly lapped work from any and every grinding wheel.

All commercial grinding, by whatever method it is accomplished, will show lines of cut and feed, when rubbed in a perfect, cylindrical hole, or when similarly lapped. There is a difference between a "commercially perfect" cylinder, with uniformly distributed contact, and a "really perfect" cylinder. The latter is one whose surface molecules all lie on the same radius, all touching the inner surface of a perfectly round ring of the same diameter, when it is rubbed over the entire length of the cylinder, whereas the former is one that shows a uniformly distributed contact over the entire length of the cylinder, when rubbed in a perfect hole.

The best grinding gives us a cylinder with uniformly distributed contact, and we should use such speeds and feeds on our machines as to produce as many points of contact as our work shall require. In all cases the points of contact between a ground cylinder and a perfect ring will be greater than those obtained on turned cylinders, even when the lathe work is filed and finished with emery cloth.

The modern view of grinding with an up-to-date grinding machine is that it enables us to size work cheaper than is possible by turning and filing, and that it takes the place of what we have called the finishing cut in the lathe, giving us not a theoretically perfect cylinder, or perfect finish, but one much nearer perfection and better in finish than we have before obtained with the lathe. Good ground work will show no feed marks or color waves before lapping in a hole.

Most specimens of ground work show a fine appearing surface, and nearly every mechanic would pronounce them good, but rubbing them parallel with the axis, with a perfectly round ring, as referred to before, brings out imperfections which otherwise would not be discovered. Whoever tries to obtain really perfect cylinders by grinding, even with narrow wheels and fine feed, is doomed to disappointment when he applies this test. He will find that the most uniformly distributed contact with a perfect hole is obtained with soft wheels, wide face, and wide cut or feed.

In my apprentice days we used to think that we were doing the best planing when we could not see the feed lines, and we regretted that we could not reduce the feed to less than one tooth of the ratchet. Our work then cost so much that if, today,

we had a planer operator, earning no more than we did in those days, he would be promptly discharged.

I well remember when Mr. William Sellers, of Philadelphia, showed us that, while the surfaces we planed then, looked nice, they were not flat, and that, with his wide cut, he produced surfaces that had a more uniformly distributed contact with the surface plate than ours did, and at much less cost. We all doubted him for a while, but today no one disputes his theory, everyone planing with the wide cut.

So the day is coming when all practical mechanics will consider the ground cylinder as most perfect and practical when the feed lines and uniformly distributed contact points can be discerned, after forcing the cylinder into a round hole.

Modern grinding means also that all lathe work should cost less than if the work was not to be subsequently ground. With properly constructed grinding machines, the coarser the turning, the quicker the grinding can be done. It is no longer necessary to turn work smoothly or correctly to size. A variation of 1/32 more or less on the diameter of large work and medium work is of no moment. On very small work a variation of 1/64, more or less, is permissible, and the surface may be very rough in all cases.

Thus, a large fraction of the economy accredited to grinding machines is secured by cheap turning. It is exceedingly difficult to secure such turning, owing to prejudice, ignorance, opposition, or fear, on the part of foremen, workmen and superintendents. It requires generalship of the highest order to get work turned rightly for grinding. All tradition must be upset to do this. There are few places, if any, where modern, powerful grinding machines are used, in which the turning is done as cheaply and roughly as it should be to secure the economy possible by grinding. Experience has taught me that there are few men who grasp the true situation in regard to less expensive turning in connection with modern grinding.

The largest possibilities lie in the new lines of turning preparatory to grinding, and in order to secure the best results, we must co-operate with the grinding machine designer and all prejudice must be overcome. With the present day idea of production, prevalent amongst many workmen, and the slogan for larger production, raised by the European workmen, we must use our wits to place ourselves in a position to hold for our American workmen their share of the world's earnings. The new turning and grinding field offers an opportunity to aid in this direction. Above all, let us co-operate to the one end—that is, economy.

There is a feature of cylindrical grinding which needs attention at this time, and that is what is commonly called "chattering," an annoyance which those of you who have had to deal with grinding have probably experienced. Most people, upon discovering these chatter marks on their work, immediately attribute them to the action of the gears revolving the work, and, without further investigation, write to the maker of the machine, in-

forming him that the gears in the machine are to blame for this defect in the work. Chatter marks are always caused by the vibration of the work itself, as it revolves.

No one, at all familiar with turning, would consider chatter marks on lathe work as caused by the gears of the lathe. In fact, some of the worst cases happen when no gears are used to revolve the work, while being turned. The chatter marks in turning are larger than those in grinding. In lathe work there is a tendency on the part of a slim piece being turned to climb over the tool several times during each revolution, only to fall back after reaching a certain point, thus causing the vibration. The only difference between this and work "chattered" in grinding is that the vibrations in the latter are slow and the number per revolution much less. The remedy for it is properly applied steady rests, and proper selection of the speed of revolving the work. Perhaps I cannot better explain this than by calling your attention to the well-known violin. The rosin covered bow, when being rubbed across the strings, causes them to vibrate, these vibrations varying in frequency according to their diameters, lengths and tension. The musician changes the number of vibrations by placing his finger on the strings in different positions, thereby altering its length, at the same time increasing the tension. If he were to literally cover the strings with a multitude of fingers, and then rub the violin bow on the string, it is evident there would be no vibration whatever. Similarly, if we apply properly shaped, entirely rigid, steady rests to cylindrical work while it is being ground, we can grind work perfectly true without chatter marks. We effect vibration by a variation in the speed of the work. Let us imagine a piece of cylindrical work mounted in a grinding machine, but not being revolved. It is evident, as it is passed by the grinding wheel, there will be no vibration, neither will there be such if we revolve it very slowly. There must be a certain relation between the elasticity of the work and the speed at which the grinding is performed, to synchronize and cause vibration. This must be avoided. It is evident then, that one remedy for chatter marks is a change of work speed, another a proper application of steady rests, or both. The latter enables us to do rapid work, while very slow revolution of the work, without steady rests, entails too much expense. In the old days, when very narrow wheels were used, there was less difficulty experienced, even without steady rests, for the reason that there was less work being done per minute; therefore, the work was disturbed less. Many suppose that chatter marks are caused by imperfect grinding wheel spindles, loose fitting boxes, etc. Those things produce different effects in the nature of what we call mottled or wavy work. Such defects are never developed in lines parallel to the axis, but are often shown in spirals around the work. All powerful grinding machines revolve the work through gearing, which is probably the most practical manner, though tradition says that work so revolved may have marks in it, caused by the gearing. In the case of the

grinding machine, however, the gear is a floating member and not attached to the axis of the work. This revolves on two dead centers, which are mounted in heavy fixed steel studs, there being no spindle in a modern cylindrical grinding machine. Therefore, this loose, floating drive can have no effect on changing the axis of the revolving work. It is argued by some that intermittent motion, caused by imperfect teeth, would produce the effect of chattering. I have made an experiment with very imperfect gears; meshing so badly as to make a loud noise, and crowding, they having been purposely prepared with errors in them, to demonstrate the fact, beyond a doubt, that an ordinary gear, with the usual errors of gearing, has absolutely no effect upon the quality of the work ground; for, some of the most perfect work ever produced in our shops was done on this experimental machine. The purpose of the steady rest has not been understood until now, and there are yet many who do not understand it. The popular belief among old time mechanics is that work not round before grinding cannot be ground round, if we place a rigid steady rest under it while working on it. In every-day practice, however, in our own works, we use rigid rests against very rough drop forgings, as well as against ordinary work. In the case of long and slender shafts, when it is desired to spot off a place perfectly round at, or near, the center of the shaft, the steady rest is placed rigidly underneath the rough stock, and the full width of the wheel face is brought in grinding contact as the shaft revolves, producing a spot perfectly round. This is true regardless of the length or size of the shaft, or the shape of the stock at the point where we grind, the steady rest being used always on the place where the grinding is done. In order to clearly demonstrate that work of almost any form can be ground perfectly round by the use of rigid steady rests, applied directly to the work, we placed a round piece between the centers of a milling machine, and milled it off on five sides at one end. We then cut off enough of the end to remove the center. A lathe dog was then fixed on the other end, and the piece was mounted with the dog end on the head center of the grinding machine, while the five-sided end rested in a fixed steady rest with no other support. Before mounting, however, the five-sided end was placed on paper, and our inspector with a sharp pencil marked around it. We then ground off about 0.080 inch from the diameter of this end, removed the piece from the machine and again marked around the end. These operations were repeated ten times. No. 10 was tested with the micrometer and no error from roundness was found.

The selection of grinding wheels for cylindrical work is very much misunderstood, and by many people is considered a very puzzling and difficult feature. To those of us who have had years of experience, this fact seems strange, for to us the matter seems exceedingly simple. To illustrate: In our own works we seldom use more than two different wheels for all kinds of work. One is a grade "K," the other a grade "L." In rare

cases we use a wheel as soft as "J" and as hard as "M" and "N." We are grinding a great variety of work for all kinds of manufacturers, both large and small. Yet we find it very difficult to satisfy the users of our machines when we furnish to them the same grinding wheels with which we are successful. This is probably due, in a large measure, to that side of human nature that prompts men to differ, and to try experiments of their own.

In this connection it may be of interest to you to know that only with great difficulty we are able at times to prevent some of our customers from making radical changes in our machines, to suit the notions of their operators or foremen.

This is an age of specialization, and cylindrical grinding is certainly a specialty. If manufacturers in this country are to succeed universally with cylindrical grinding, it will be necessary for them to take in perfect faith what they are taught by those who have made it a life work. When the grinding machine is properly used, the savings through its use are enormous. They are so great that when the facts are presented, one not an expert in this line invariably doubts them.

With our American desire for progress and economy, we can do no better than to give the matter of cylindrical grinding a more open and careful study, more so than we have done in the past, and especially to the end of securing large economy. European manufacturers were first to adopt modern American cylindrical grinding machines, and American manufacturers are now following, many being now equipped with machines.

The cylindrical grinding machine has taken its place as a practical metal-cutting tool, to be used by progressive manufacturers as a labor saver; and manufacturers, to whose attention its possibilities have been brought by practical demonstrations, have accepted it as a settled method of sizing cylindrical work.

As a labor saving tool, it has been, and to some extent still is, unpopular with a certain class of workmen, who look with suspicion upon all tools for increasing production. This attitude, however, will soon be changed, in my opinion, for the reason that workmen are learning that by the use of the grinding machine they can make themselves much more valuable, and thereby gain a larger income. The cylindrical grinding machine, requiring, as it does, more thought, greater caution, and more intelligence in its operation, than the lathe or planer, I believe, tends to elevate the position of the workman. This view is being taken by many today who, a few years ago, were opposed to it.

There is a demand for thinking young men, who have tact, care and refinement in their methods, to become experts in the operation of modern cylindrical grinding machines. The field is growing broader each year, and this tool is destined to play an important part in the world's progress, in point of labor saving and labor elevating devices.

(A number of lantern slides were used in the presentation of this paper, cuts from which could not be obtained for illustrating this article.—The Publication Committee.)

Halley's Comet

Summary of Lecture Given Before the Society, May 10, 1910, by Prof. D. T. Wilson, Ph. D.

Up to the beginning of the 18th century, the only clear knowledge the world had of comets was their existence. Occasionally someone would note its position in a certain constellation on a certain date. The mysterious way in which they appeared for a few weeks or months and then disappeared, gave rise to numerous superstitions about them. They were thought of as winged and wicked creatures, flying around in the earth's atmosphere, meddling with the affairs of men. It was confidently believed that a comet was a premonition of some great change in the life of the people. Usually it presaged war; and indeed, that superstition has not yet entirely disappeared. It is said that Napoleon always thought of the great comet of 1769, the year of his birth, as his protecting genius. One of the brightest comets in a century appeared in 1811. This he looked upon as a guarantee of the success of his Russian campaign. The genius failed.

Tycho Brahe was the first to ascribe to comets an extra-terrestrial existence. By using observations of the comet of 1577, taken in different parts of Europe, he was able to show mathematically that its distance was greater than that of the moon. Comets were known to move among the stars, but as the law of gravitation had not then been discovered, no one knew the cause of their motion or the kind of path in which they were moving. Kepler thought they moved in straight lines and was half disposed to consider them living creatures guiding their own destiny. Hevelius, a Polish astronomer, in 1675, was the first to suggest that their orbits, or paths, might be parabolas. Doerfel, in 1680, proved this to be the case for the comet of that year. About this time, Newton discovered the law of gravitation. By means of this law, he showed that any mass of matter like that of a comet, attracted by the sun, would describe a conic section, either a parabola, hyperbola or an ellipse around the sun, which is at one focus of the curve. He showed how to compute an orbit of a comet from observations of its positions, taken at different intervals of time.

Edmund Halley, Professor of Geometry at Oxford, a warm personal friend of Newton, was the first to appreciate the value of this discovery. He began gathering observations of comets and computing their orbits. Studying his list of twenty-four orbits, he saw that those of 1531, 1607 and 1682 moved in the same path around the sun. He concluded that these orbits were not parabolas, as he at first assumed, but elongated ellipses, and that these

were different appearances of the same comet, whose elliptic orbit was so large that a period of seventy-five years was required for its complete revolution around the sun. He calculated that it should appear again in the year 1758. It appeared in 1759, being retarded by the action of the planets, the effect of which Halley could not fully compute. While Halley did not discover the comet which bears his name, he did discover the fact that it was periodic.

When a comet comes into the solar system, the attraction of the planets either accelerates or retards it in its motion. Halley's comet is retarded, and by different amounts at each return. Its period varies from seventy-four to seventy-nine years, depending upon the distances of the comet from the several planets as it passes them. Notwithstanding the difficulty of this problem, Messrs. Cowell and Cromelin, of England, with nothing but the observations of 1835, were able to compute the time of perihelian passage of 1910, so nearly that the actual time differed from the computed time by only four days. Extensive investigations by these men have revealed the fact that many of the comets of history are different appearances of Halley's comet. Its history has been traced back to 87 B. C. The great comet of 1066, which, according to popular superstition, aided William the Conqueror in his invasion of England, was none other than that of Halley's. The services supposed to have been rendered by the comet along with other important events of the campaign are recorded on the famous Bayeux tapestry. It was Halley's comet which, according to Josephus, the historian, gave warning of the destruction of Jerusalem in the year A. D. 66. He says: "What shall we say to the comet that hung over Jerusalem for one whole year, in the figure of a sword?" He then rebukes his countrymen for listening to false prophets, while so notable a sign was in the heavens. The comet is with us again and is attracting more attention than it has ever done before.

The motion of comets is known to as high a degree of accuracy as could be desired, but their physical properties still present perplexing and baffling problems. Their masses are known to be very small, while their volumes are very large. It is not known whether the nuclei, or central portions, are composed of large or small particles of matter. Part of the light they give off is reflected sunlight. They are certainly, to some extent, self-luminous, although it is hard to conceive matter as tenuous as that of a comet must be, at a temperature of probably 270 degrees below zero, can be hot enough to shine of its own light. While the comet, as a whole, obeys the law of gravitation, the particles of which the tail is composed, seem to disregard that law, for they move in the opposite direction from the sun as they are released from the comet's head. These are some of the physical properties which the astronomer hopes to get some light on during the brief visit of Halley's comet.

About 10 o'clock, on the night of May 18, an unusual event will occur. The comet will pass directly between the earth and

the sun. At that time, it will be only fourteen million miles from the earth. If there is a solid mass of matter in the head of the comet, having a diameter of five miles, or greater, it should appear, in a telescope magnifying one thousand times, as a dark spot on the bright background of the sun. Observing parties have been stationed on the Hawaiian Islands and on the Continent of Asia, to try to observe this transit of the comet. There is very little hope of any definite results, but the astronomer does not want to lose any possible opportunity of acquiring even a fragment of the great unknown truth of the universe, to the discovery of which he is devoting his life work.

The sun, while it attracts the head, repels the tail of a comet. The best explanation so far given of this phenomenon is that the particles of matter, composing the tail, are driven away from the head by the pressure of light. It has been found by computation that if a particle of matter has a diameter of one twenty-five-thousandth of an inch or less, the repulsive pressure of the sun's light will exceed the gravitational attraction of its mass. Such a particle then, instead of being attracted toward the sun, will be driven away from it. The position of the tail, always away from the sun, is explained on this theory.

The chemical composition of comets has been studied by means of the spectroscope. Hydrogen, the hydrocarbon gases and iron have been found. A recent spectrogram of Halley's comet by Frost, of the Yerkes Observatory, reveals bands showing the presence of cyanogen gas. No cyanogen was found in the tail, although three degrees of it showed in the spectrogram. Thus, little by little, are gathered fragments of knowledge about these mysterious celestial visitors.

(The lecture was well illustrated by lantern slides, but no cuts were available to pertinently elucidate this article.—PUBLICATION COMMITTEE.)

The Visit to the Technical High School

On the evening of October 24, 1910, the members of the Cleveland Engineering Society visited the Technical High School of this city, to inspect the work and visit the shops and laboratories of the institution. The members assembled in the auditorium of the school at 8:00 P. M., where they were met by Principal Barker and Assistant Principal Mathewson. Before starting about the building, a short talk on the aims and purposes of the school was given by Mr. Barker, of which the following is the essence:

"The prime function of the school is to prepare boys to enter the industries of the city with the prospect of eventually attaining

TECHNICAL HIGH SCHOOL.

positions above those of the rank and file of the workman. A second object of the school is to fit boys to enter the engineering profession by preparing them for technical colleges, and to date most of the boys have followed this plan. The high school course is essentially a scientific one, English, mathematics and science being the fundamental requirements, with some history and a possible two years of German. The usual four years' work of manual training is condensed into the first and second years of the school, and during the third and fourth years pupils are allowed to specialize in some one branch of the technical work, devoting from 15 to 25 hours a week to this branch during two years of the work. Boys may specialize in mechanical or architectural drawing, machine shop practice, pattern-making, cabinet-making

or printing. To date the machine shop has proved the most attractive to the largest numbers.

"On the girls' side, the purpose of the school is three-fold. The primary object is to fit the graduates to take up the responsibilities of a home. In addition to this, they may prepare for girls' technical schools, or acquire the foundation of a trade. The same opportunity is offered to the girls, as to the boys, to specialize, and they may study dressmaking, millinery, institutional cooking and industrial art.

"Two separate schools are maintained in the building, the girls' work being entirely differentiated from that of the boys, there being no recitations in common. This is brought about by the fact that the academic studies of each are treated from different standpoints. The boys' English is that adapted to their needs, and varies from that of the girls'. In the same way the boys' course in mathematics applies to their shop work, and the girls' studies to the problems of the household. The science of the boys' department is also related to the industries, while the work of the girls is entirely domestic. For instance, the boys' chemistry leads to the chemistry of materials commonly used in the industries, while the girls' work deals with foods and their chemical properties. In the physics course the development is along mechanical and electrical lines for the boys, and along the heating, ventilating and lighting of a house for girls.

"The school is in operation throughout the 12 months of the year, which are divided into four groups of three months each. The unit being a quarter of a year, 12 units are required to complete the course. These may be taken consecutively, the pupil graduating in three years, or taken in four or more years, as necessity dictates. There are, therefore, 12 grades of work, beginning every three months of the school year, so that pupils may enter and graduate each quarter.

"The school is part of the public school system of the city of Cleveland and is open to all pupils of the city, who have completed the eighth grade of the grammar school. No tuition is charged. It was first opened in October, 1908, with a little over 600 students. In 1909, there were 1,000 in attendance. The proportion of girls to boys is about three to one. The enrollment at the present date is a little over 1,350. This includes all grades, though there are only about 20 of the number who have reached the fourth year. Next year, with four complete classes, an enrollment of 1,600 is expected. The Board of Education has already purchased land and plans are about completed for a similar school on the west side of the river.

"During 1906, 1907 and 1908, about 4,800 pupils annually were attending the public high schools of Cleveland. Since the opening of the technical high school, in 1908, and the high school of commerce, in 1909, this enrollment has increased 31 per cent, or to a total of 6,300. In other words, the vocational schools have opened up to 1,500 pupils the possibilities of an education. These boys and girls would otherwise not have been, in all probability, in

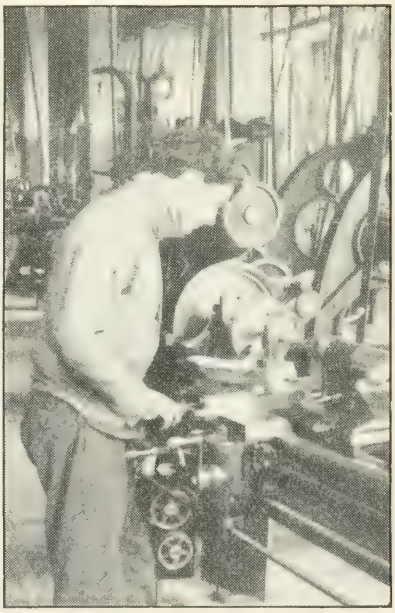
high school at all. In addition to this, there are 350 enrolled in the night classes.

"The expense of such an institution is great. The per capita cost will probably run over $100 a year, but the tangible results to be obtained by the girls and boys of the city should warrant the expenditure."

The trip about the building consumed about an hour and a half, Mr. Barker taking one group and Mr. Mathewson another. The print shop, art department, dressmaking, millinery and cooking rooms, were visited. The members were also shown the five mechanical drawing rooms, the turning room, the four carpenter shops, the two pattern shops, the foundry, the two machine shops, the blacksmith shop, and the pottery department. The chemical and physical laboratories, the gymnasium and the lunch room, were also inspected.

After the tour of the building, the members of the Society adjourned to the auditorium again, where a discussion ensued relative to the advantages and disadvantages of the school. The meeting adjourned at 10 P. M., all feeling well repaid for the time given to the investigation of one of the most unique educational institutions, of which every Clevelander can justly feel proud.

A vote of thanks was extended to Principal Barker and Assistant Principal Mathewson for their courteous reception and attention, every one being convinced that much credit belongs to Mr. Barker for the planning and conduct of this novel school.



TECHNICAL HIGH SCHOOL PUPIL AT WORK.

Minutes of Meetings

Special meeting, Tuesday, May 31, 1910, called to order by the President, at the rooms of the Society, at 8:30 P. M.

Present—Twenty-two members and visitors.

Mr. R. L. Humphrey, Engineer in charge of the Structural Materials Testing Laboratory of the U. S. Geological Survey, Pittsburg, presented an exceedingly interesting paper entitled "Structural Materials, Fuels and Mine Accidents," illustrated by many lantern slides.

An interesting discussion followed, many questions being asked by those present and answered by the speaker.

On motion of Mr. Osborn, a vote of thanks was tendered the speaker.

Adjourned.

JOE C. BEARDSLEY,
Secretary.

Regular annual meeting, June 14, 1910, called to order by the President at 7:30 P. M., at the Cleveland Athletic Club.

Present—One hundred and ten members and guests.

Reading of minutes dispensed with.

The tellers reported the election of the officers named in the attached ballot for the ensuing year, and the election to active membership of the following: Mr. Maurice Converse, Mr. Charles P. Jeager, Col. John Millis and Mr. Charles B. Tyler.

Program of the meeting is attached.

Adjourned.

JOE C. BEARDSLEY,
Secretary.

Regular meeting of the Society at the Club Rooms, September 13, 1910, was called to order at 8:00 P. M., by President Frazier.

Present—About fifty members.

Minutes of meetings May 10, 24, 31 and June 14, were read and approved.

The Executive Board reported that they had approved for active membership, the applications of—

W. H. ABBOTT
(Now Associate)
GEORGE ARNOLD, JR.
LOUIS L. BALDWIN, JR.
THOMAS A. BARCO
WILLIAM W. BOURNE
HARRY A. BROWN
FRED W. FEIHL
JOHN E. GRADY
HARVEY E. HACKENBERG
(Now Associate)
WILLIS W. HALE
EDWIN C. HENN
EDGAR E. JAMISON
AUGUST W. JANSSON
JOHN C. JOHNSON
EDMUND H. JONES
EDWIN T. KING
BOYD LESH
FREDERICK W. LOVELL
VIRGIL G. MARANI
(Formerly a member)
EARL H. MARTINDALE
CHARLES E. NEWELL
CARROLL A. PEABODY
HARRY S. PICKANDS
HENRI A. D'O. SAURBREY
JAMES J. SMITH
(Now Associate)
RICHARD L. TAPPENDEN
FRANK A. VAUGHAN
CARL D. WALLACH
RALPH H. WEST
GEORGE E. WOODFIELD
AND WILLIAM P. WILBUR
(to replace Mr. Kalb, of the National Carbon Co.)

On motion duly seconded, these names were ordered to letter ballot for canvass at next regular meeting.

For associate membership, applications of—

David Aitken and Frederick L. Foshay.

On motion duly seconded, these names were ordered to letter ballot for canvass at next regular meeting of the Society.

For corresponding member, application of Fred A. Bell.

On motion duly seconded, this name was ordered to letter ballot for canvass at next regular meeting.

The Secretary read the following communication, which had been received and unanimously approved by the Executive Board:

Cleveland, Ohio, Sept. 12, 1910.

Executive Board,
The Cleveland Engineering Society, Cleveland, Ohio.

Gentlemen:—

We, the undersigned, respectfully propose that Honorary Membership in our Society be conferred upon General James Barnett, who has been an active member of the Society and one of its consistent supporters since April, 1880 (one month after the organization meeting).

Our reason for suggesting this action is that General Barnett is eminently worthy of this honor on the grounds of his unique record as set forth below, which has so often found recognition by journalists, historians and others, in referring to him as "Cleveland's First Citizen" and "Cleveland's Grand Old Man."

He was a conspicuous figure connected with the early iron industry in Cleveland, being one of the founders and a director of the Cleveland Iron Company, which was organized at the close of the Civil War, and operated a rolling mill for a number of years.

He was financially interested for years in the Brown Hoisting Machinery Company, one of Cleveland's most prominent engineering establishments, being the father-in-law of the active head of this concern, Mr. Alexander E. Brown, one of the past presidents of this Society.

As President of the Geo. Worthington Company for about forty years, he was the active head of a house of wholesale and retail hardware merchants, also notable dealers in all kinds of power plant equipment and factory supplies.

He was President of the First National Bank of Cleveland for about thirty-five years, his service as head of a bank being unprecedented in this country.

For many years he was President of the Associated Charities and the Humane Society of Cleveland, in which connection his big-heartedness and philanthropic spirit found unselfish expression.

He was a Lieutenant of the old Volunteer Firemen of Cleveland, and a Colonel of the First Regiment of Ohio Light Artillery which rendered such conspicuous service during the Civil War, meriting the special recognition of Congress, which rewarded Colonel Barnett by brevetting him to the rank of Major-General at the close of the War, an act which again singles him out, since he is the only Artillery Officer so distinguished.

The Society will be graced by adding a third U. S. General to its list of Honorary Members, and we believe that General Barnett would accept the honor with appreciation.

Respectfully submitted.

Willard Beahan	Geo. H. Tinker	Geo. F. Burrows
E. E. Ranney	F. W. Ballard	Frank C. Osborn
W. O. Henderer	Bernard L. Green	David Gaehr
H. E. Hackenberg	J. W. Frazier	M. C. Canfield
R. H. Fernald		Robert Hoffmann

On motion duly seconded, the recommendations of the Board were approved and General Barnett's name ordered placed upon the roll of Honorary Members, also, General Barnett notified of the Society's action.

Upon motion duly seconded, the following changes in the Constitution, unanimously recommended by the Executive Board, were approved and ordered to letter ballot:

ARTICLE II, Section 1, the insertion of a second paragraph to read "Memberships in the Society may be held by firms, partnerships and corporations, who shall designate one representative for each membership. These representatives shall make application in the regular form, subject to the requirements of the Constitution regarding eligibility, election and dues. The regular initiation fee shall be paid for each membership so held."

ARTICLE IV, the insertion of another section as follows: "Section 9. *Firm Memberships*—Memberships held by firms, partnerships and corporations, may, at the option of the holders, be transferred to other incumbents after these have made application and secured election in the regular manner, the holders having previously given due notice to the Secretary of the Society, declaring the membership in question vacant.

"Any such member wishing to retain his standing in the Society, after leaving the employ of the holder of his membership, or for other reasons wishing to have it stand in his own name, shall be allowed to do so, without requiring a new election, by payment of the initiation fee and the dues from the date of transfer on, otherwise the above notice from the holders of his membership shall operate as a resignation on his part."

ARTICLE II, Section 5, changed from—"Corresponding Members shall have the same qualifications as Active Members, but their residence must not be within thirty miles of the Public Square, Cleveland, Ohio"—to—"Corresponding Members shall have the same qualifications as Active Members, but their residence must not be within the limits of Cuyahoga County, Ohio."

ARTICLE IV, Section 1, changed from—"An Active Member on removing his residence beyond thirty miles from the Public Square, Cleveland, Ohio, may become a Corresponding Member, by filing an application with the Secretary, after paying all dues for the current fiscal year.

"A Corresponding Member shall be transferred to Active Membership on taking up permanent residence within thirty miles of the Public Square, Cleveland, Ohio, to date from the first of the fiscal year following such change of residence"—to—

"An Active Member on removing his residence beyond the limits of Cuyahoga County, Ohio, may become a Corresponding Member by filing an application with the Secretary, after paying all dues for the current fiscal year.

"A Corresponding Member shall be transferred to Active Membership on taking up permanent residence within the limits of Cuyahoga County, Ohio, to date from the first of the fiscal year following such change of residence."

Adjourned.

F. W. BALLARD,
Secretary.

Special meeting, Sept. 27, 1910, in main auditorium of the Cleveland Chamber of Commerce, called to order by President Frazier, at 8:15 P. M.

Present—Two hundred and seventy-four members and visitors.

The paper of the evening was given by Mr. Robert Hoffmann, City Engineer, on "Grade Crossing Elimination," and was illustrated with lantern slides, showing completed work, work now in progress, and contemplated work on a number of the important crossings.

The various phases of the work were then discussed by Mr. Himes, of the Nickel Plate; Mr. Leffler, of the Lake Shore; Mr. Ray, of the B. & O., and Mr. Bissell, a local engineer, representing neither interest.

Adjourned.

F. W. BALLARD,
Secretary.

What the Society is Doing

It is doubtful if the majority of our members realize very much of what the Society is doing. In the September JOURNAL we gave an outline of some of our plans, but it was hardly possible to give in that way and in advance, a very definite idea of all we had in mind and what we were setting out to accomplish. Of course, we do not mean to say that we have already put into effect nearly all of the things that we were then starting out to do, but what has been done will no doubt strengthen the confidence of our members and make them realize that our ideals are not mere idle dreams, but are practical, and possible of realization. We believe that by following up the work, which we have already started upon, the Cleveland Engineering Society will soon be known not only as a technical organization, whose object is to advance the knowledge of its individual members in technical subjects, but also as one of the leading, if not the foremost, civic bodies in this municipality.

We have changed the location of our headquarters and now occupy rooms on the fourth floor of the Chamber of Commerce Building. These rooms are more centrally located, and are very much more convenient than our old quarters; they are more commodious and more pleasant. Two views are shown herewith: The first is the library and reading room; the second shows the offices for the Secretary and President. The office of the Secretary is occupied at all times by the Assistant Secretary, Mr. G. S. Black, and will be devoted to carrying on the routine business of the Society, while the President's office will be used for meetings of the Executive Board and of the various committees. In addition to and adjoining the library and reading room, which is 19 x 35 feet, we are now fitting up a room for billiards and pool, which is 26 x 35 feet. Our members should make it a point to use these rooms on all occasions possible, thus enlarging the club features of the Society and broadening our views in general by becoming acquainted with the other members and learning what they are doing. The rooms are open every day in the week, from 11:30 A. M. to 10 P. M.

As previously announced, one important feature in connection with the renewed activity of the Society consists in the appointment of various committees to work along lines of civic improvements. Some of these committees have already been appointed and are at work; others have not as yet been completed, owing to the difficulty of finding the right men to put on them. Along these lines, the following committees have been decided upon: Rivers and Harbors; Bridges and Grade Crossing Elimination;

LIBRARY AND READING ROOM.
(Looking west.)

Building Code; Franchises and Municipal Plants; Water Purification and Sewage Disposal; and Street Railways and Subways.

The following members are serving on the Rivers and Harbors Committee: Mr. Willard Beahan, First Assistant Engineer, L. S. & M. S. R. R., Chairman; Mr. E. P. Roberts, President, Roberts & Abbott Company; Mr. G. F. Burrows, Engineer in Charge of Estimating Department, Wellman-Seaver-Morgan Company; Mr. C. W. Comstock, President, the Comstock-Wellman-Bronze Company; Mr. James A. Smith, Manager, Great Lakes Dredge & Dock Company; and Mr. W. B. Hanlon, Consulting Engineer on Railways and Mines, 412 Electric building.

The Committee on Bridges and Grade Crossing Elimination has been appointed and is at work: Mr. C. H. Wright, Chief Engineer, the Brown Hoisting Machinery Company, Chairman; Mr. F. C. Osborn, President, the Osborn Engineering Company; Mr. B. R. Leffler, Engineer of Bridges, L. S. & M. S. Ry.; Mr. C. W. Hopkinson, Architect, 900 Rose building; and Mr. H. C. Fuller, Chief Engineer, King Bridge Company. This committee is a very important one and is expected to immediately become familiar with all features in connection with the proposed high level bridge, and to follow it through to completion. A great many things naturally arise in connection with a structure of this kind, which it is of vital importance to the interests of the community to have thoroughly discussed from all points of view, in-

cluding the technical side, before definite action has been taken. We believe in making it the function of this committee to see that publicity is given in a proper manner to these things, that we are rendering the community a very valuable service. The same duties will devolve upon this committee in regard to the grade crossing eliminations. The fine paper, which was read in an open meeting of the Society by Mr. Robert Hoffmann, City Engineer, in the Chamber of Commerce Hall, on the evening of September 27, and the able discussions of this paper by several of our members, will give some idea of the manner in which we expect to handle these questions. Mr. Hoffmann's paper and the discussions are published in full in this issue of the JOURNAL. The work of following up progress on grade crossing eliminations, has, of course, only just started, and our members and the public at large may expect to hear from this committee from time to time, as we intend to make public their reports.

The Building Code Committee has not yet been completed. The following members, however, have already been appointed: Mr. B. L. Green, of the Osborn Engineering Company, Chairman; Mr. S. W. Emerson, of the W. B. McAllister Company; Mr. W. J. Carter, Consulting Engineer, 1315 Rockefeller building; and Mr. F. W. Carroll, of the Reaugh Construction Company. Other members are under consideration for appointment on this all-important committee. It is the intention to make this com-

SECRETARY'S AND PRESIDENT'S OFFICES.
(Looking west.)

mittee large enough and to include in its personnel, men experienced along all lines of engineering, architecture, etc., so that adequate consideration can be given to the many and varied problems involved. We all know that the present building code is not satisfactory in many ways, but all recommendations for change should receive careful consideration from all points of view and from all interests affected.

Mr. Virgil G. Marani, Building Inspector for the City of Cleveland, will read a paper on the Building Code before this Society, in the near future. Mr. Marani's paper will doubtless give us some very valuable information and suggestions, and we expect our committee to not only devote careful consideration to all of the questionable features of our Building Code, but to make an exhaustive study of the way the various questions are handled by the other big cities before making their report and recommendations for changes.

The other committees are under consideration, but have not yet been appointed. They are also very important, and it is desired to get the best men possible upon them.

In addition to our own committees, we have been called upon to name members to represent the Society on other commissions concerning various matters of great importance to the community. The Society was requested by President Kinney, of the Chamber of Commerce, to name three members to serve with the Commission on Municipal Art and Architecture. The Executive Board appointed the following members to represent the Society: President J. W. Frazier, Prof. R. H. Fernald and Mr. F. C. Osborn.

We were requested by President Ashmun, of the Board of Education, to appoint two of our members to serve on the commission for investigating the affairs of the School Board. Mr. Willard Beahan and Mr. E. E. Ranney were appointed to represent the Engineering Society on this commission.

On November 23, we received a request from the Director of Public Safety, Mr. F. C. Hogen, to name two of our members to act with an equal number from the Builders' Exchange, and the Cleveland Chapter of the American Institute of Architects, as a commission to investigate the causes leading to the collapse of the H. A. Henke Furniture Company's building, at Lorain avenue and West Thirtieth street, the night of November 22. A special meeting of our Executive Board was called at once, and Mr. B. R. Leffler and Mr. W. O. Henderer were appointed to serve on this commission.

Our members should not fail to attach sufficient importance to the privileges and opportunities which are now opening up before us of serving the community. The Society, as well as the individual members, will be known by its works, and it is a trite saying that "the man who never does any more than he is paid for, will never be paid for any more than he does." If we were to look at the matter from a purely selfish and personal consideration, still it would be decidedly to our interest, paradoxical as it may seem, to do all in our power to give to the society and to the

community at large, the best service in our power to render. But let us forget that side of the question and take an interest in the public and civic problems of the community, and share in the grand work of making Cleveland the best and foremost city in the world.

F. W. Ballard, *Secretary.*

Library

The new reading room and library is a very pleasant place The arrangement of the books in the cases is only temporary, as it will be necessary to re-arrange the stacks when the additional rooms are secured. New cases are to be purchased for additional stacks, since the cases on hand will not accommodate the total number of volumes belonging to the library. In the old quarters, because of lack of additional stack room, many volumes had to be stored in the cases in such a way as to be not readily accessible. It is hoped that this objection can be overcome in the new quarters.

The library of the late Albert H. Porter, consisting of 137 bound volumes, has been presented to the Society. It contains the following titles:

Transactions Am. Soc. of C. E.....	36 Volumes.
Engineering News.....	24 Volumes.
Railroad Gazette.....	29 Volumes.
Eclectic Engineering Magazine.....	28 Volumes.
Journal Assoc. Engineering Soc.....	20 Volumes.

The new activity of the Society and the increase of membership will place additional demands upon the library. In order to meet them, it is necessary that the library should have an income. A great deal may be accomplished with a moderate amount of money intelligently used. At the present time, the library is living on less than $200 per year and the demands for new and up-to-date works are entirely beyond its resources. The Society has among its members many public spirited men of wealth. It is believed that no more useful investment of money for the public good can be found than the providing of a Library Endowment Fund.

LIBRARY COMMITTEE.
GEO. H. TINKER, *Chairman.*
WILLARD BEAHAN.
F. H. FERNALD.

Donations to the Library

Through the courtesy of Mr. R. L. Humphrey, President of the National Association of Cement Users, a complete set of the Proceedings of the Association has been presented to the library. These Proceedings are very valuable, containing the best literature upon the subject of concrete.

Wanted

The following volumes of the Transactions of the American Society of Civil Engineers are wanted to complete the set in our library: Volumes 50 and 54 to 63 inclusive. Members having duplicate copies of any of these, or who do not care to preserve their back volumes, can confer a favor on the Society by presenting them to the library.

Book Review

We regret that this month no new books have been received, of which we may present a review, except a copy of catalog No. 35, of the Webster Mfg. Co., of Chicago, Ill., describing a complete line of conveying, elevating and transmission machinery, together with tables and data of interest to engineers, using this class of machinery.

The Program Committee

The Program Committee find the outlook very flattering for an interesting list of papers, to be given at the remaining meetings of the year. The indication is that it will be found desirable to hold some extra meetings in order to take care of the material in hand.

The coming papers are divided among the several branches of engineering, including electrical, mechanical, civil, railroad and manufacturing; also a paper dealing purely with Physics.

Arrangements have been made for an interesting and instructive humorous lecture and demonstration of the Gyroscope, to be given by Prof. Montraville M. Wood, in January. This lecture will be held in the main auditorium of the Chamber of Commerce and will be one of the most interesting events of the season. We are all familiar with the simple form of Gyroscope, but it is rare indeed that one has an opportunity to witness the remarkable demonstrations, which Prof. Wood will give with the elaborate apparatus at his command.

Geo. B. Dusinberre, Chairman

E. H. Owen
C. W. Brown
W. O. Henderer
J. E. A. Moore
H. A. Barren
H. B. Dates
H. M. Lucas
F. A. Pease

Short Time Notes by the Chairman of the Finance Committee

We need money.

We need men.

As an Engineering Society, we will receive what is due us.

We should pay what we owe, to our members as well as to others.

It is not worth while to pay dues unless we are doing.

Have we merely new rooms, or have we a home?

Do not keep the curtains down, let the light shine out and welcome the stranger.

Internal development, external growth.

Intensify the farming methods, and also add acres.

Personal—Are you in chemical combination with the active elements of the Society, or one of the surplus atoms?

Collectively—The Society cannot maintain steam without fuel.

Each ton of coal has a certain number of heat units.

Help to get all the tons you can, each of high intrinsic heat value; it is up to the Executive Committee to furnish conditions suitable to economic combustion. The Finance Committee objects to overdrafts.

The Lord loves a cheerful giver. The Finance Committee is less particular, it will love you and pay no attention to your state of mind if you will pay your dues and obtain new members.

Just mesh in Gaehr with the Chairman of the Membership Committee, and the whole machine will move along smoothly, to the admiration of observers and the satisfaction of each element of the mechanism.

E. P. Roberts.

Employment Bulletin

It has always been the custom of the Society to act as an employment medium for its members, and in order to make this more effective, the Board of Directors have requested the Publication Committee to allot sufficient space in each issue of the JOURNAL for advertising purposes for this department. They have also instructed the Secretary to give this matter his special attention, and to systematically compile the necessary data for both "Positions Vacant" and "Men Available," all information received to be treated confidentially and handled by serial numbers only.

For the present, no charge will be made for these services. It is hoped that the department will develop so as to become a very attractive membership feature.

Naturally, many changes will occur during the interval between the dates of publication of the JOURNAL, so that the efficiency of the department cannot be gauged by the contents of this page, which records only the status at the time of publication.

It is the desire of the Board of Directors that all members wishing to employ engineering services, as well as those seeking positions, confer with the Secretary at once.

By order of the Board of Directors:

J. W. FRAZIER, *President.*
F. W. BALLARD, *Secretary.*

POSITION VACANT.

As this issue goes to press, the Secretary wishes to announce that he has received notice of a vacancy for a structural engineer. The information received, however, is not sufficient to publish in detail in this issue.

MEN AVAILABLE.

No. 1. Active member of the Society; American, 28 years old, common and high school education, experience in architectural drafting about two years, shop experience with manufacturer of conveying machinery about one year, detailing and designing on this class of work about two years, engineer for mining company about two years, lately designer on locomotive cranes, lifting magnets and excavating machinery.

No. 2. Corresponding member of the Society; American, 32 years old, common, high school and technical education (Cornell, 1901, M. E.), varied experience as demonstrator and rodman about six months, drafting room and shop experience with manufacturing engineers in conveying machinery, assistant to superintendent of shops about three years, designer and erecting engineer with crane builders about two years, assistant superintendent and later superintendent of Portland Cement Company about four years.

Practical Points

A minister, driving along a country road, noticed a small boy industriously hoeing potatoes, all alone in a field, unconcerned about his surroundings and not even distracted by passing vehicles. This being a rather uncommon phenomenon, the clergyman stopped to inquire into the motive, and addressed the boy as follows: "Hey, little man, what makes you work so hard when there is no one watching you and no one to prod you? What do you get for doing this?"

The lad replied briefly and concisely, "Nothin' if I do, and hell if I don't," and kept on hoeing potatoes.

This lad's relation to his employer or possibly to an awfully strict dad, typifies the relation between the publication committee and the president of our Society. The kid was sponsor for the committee.

(We wonder how the other committees find it.—PUBLICATION COMMITTEE.)

* * *

The gist of the following is better appreciated after reading Mr. Hoffmann's paper in the fore part of this JOURNAL.

"No, I don't think women will ever succeed as railroad engineers."

"Why not?"

"They lose too much time holding up their trains at crossings."

Items of Interest

Attention is called to the coming Cement Show, to be held at Madison Square Garden, Dec. 14-20, 1910, and the convention of the American Association of Cement Users and the Association of American Portland Cement Manufacturers, held at the same time and place.

* * *

By the first of the year, the Membership Committee will have secured over 100 new members.

Has each member done his share?

We want at least another hundred.

Vol. III No. 3

JOURNAL

OF

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The Transportation Problem of Greater Cleveland

A. B. Du Pont, E. E.

Passenger transportation in cities clearly divides itself into two stages; firstly—the exclusively surface transportation stage, secondly—the rapid transportation stage, whether it be upon the surface, overhead or underground. The first stage begins at that time of a municipality's growth when it has reached an area so large that it becomes impossible for citizens to travel on foot from one part of the city to another. Now commences the building, operation and development of a system of surface or street car lines.

The second stage begins at that period when the area of a city has grown so large that the time required to carry passengers on surface cars is so great, that it becomes a deterrent factor in business and social life. It is at this stage that the transportation problem becomes most important, because the means finally adopted as a solution of the problem, will, more than ever before, affect, either directly or indirectly, the entire growth and development of the city. It becomes apparent that surface lines are no longer adequate to meet the city's transportation requirements and that this inadequacy tends to limit the city's area to a compact and congested district. At this period, the first chapter on Rapid Transit will be written in the city's transportation history. It will be proclaimed that rapid transit not only enlarges the city, but that it also enlarges the sphere of the citizen's activities; that while the installation of a system of rapid transportation has become an absolute necessity for the general welfare of the city, it will furthermore enable citizens to live at some considerable distance from their daily work—away from the city's noise and grime—where the air is pure and the surroundings are pleasant.

I want here to consider for a moment the question of street and traffic congestion.

No one will claim that the lack of proper transportation facilities is the sole cause of the congestion at and near the center of large cities. There always has been, and perhaps always will be, a certain class of people who are forced, partially by desire and partially by the necessity of the strictest economy, even in the matter of car fare, to live close to their daily business—men and women, whose occupation demands that they be at their place of work early in the morning and who, for various other reasons, desire to live close to the business section of the city. As soon, however, as it requires from twenty minutes to three-quarters of

an hour to make the trip, the number of people who feel that they cannot spare the time increases greatly, and the result is congestion.

The greatest example of a city growing so fast that adequate transportation could not be provided is London, which is known as "a city of seven cities." The city of London being composed of seven cities distinct from each other, its citizens visit with each other just about as infrequently as we, here in America, visit between our cities which are 50 miles apart. This condition resulted because London had reached a great growth before any sufficient and practicable system of rapid transit had been devised and people found it necessary to build up a shopping and factory district within a reasonable distance from their own homes. The disadvantages of such a system are so obvious that they need no comment.

New York, in addition to surface railways, has several transportation lines, operated wholly upon elevated structures, as well as railways operated underground. In New York, because of that city's great size, as well as peculiar shape, we have the transportation problem in rather an acute form and the city has tried almost every known method to successfully solve it. Plans are being considered at present, which would necessitate the expenditure of more than $100,000,000 in building additional subways in the city of New York. This great sum is estimated as the cost of the contemplated underground excavation and construction only, and does not include the cost of cars, track or other equipments.

Chicago, in addition to its surface railway, uses elevated structures exclusively for rapid transportation and at present is very much interested in the study of its future needs by the way of subway rapid transit. The municipality has employed engineers, who are at work preparing plans for a subway.

Philadelphia has only one railway, which attempts to give rapid transit. This line uses a tunnel through the business district and runs on elevated tracks through the residence section. There is a company at the present time, trying to secure a grant to build a second subway terminal in the business section of the town, with three elevated branches running to various residence sections.

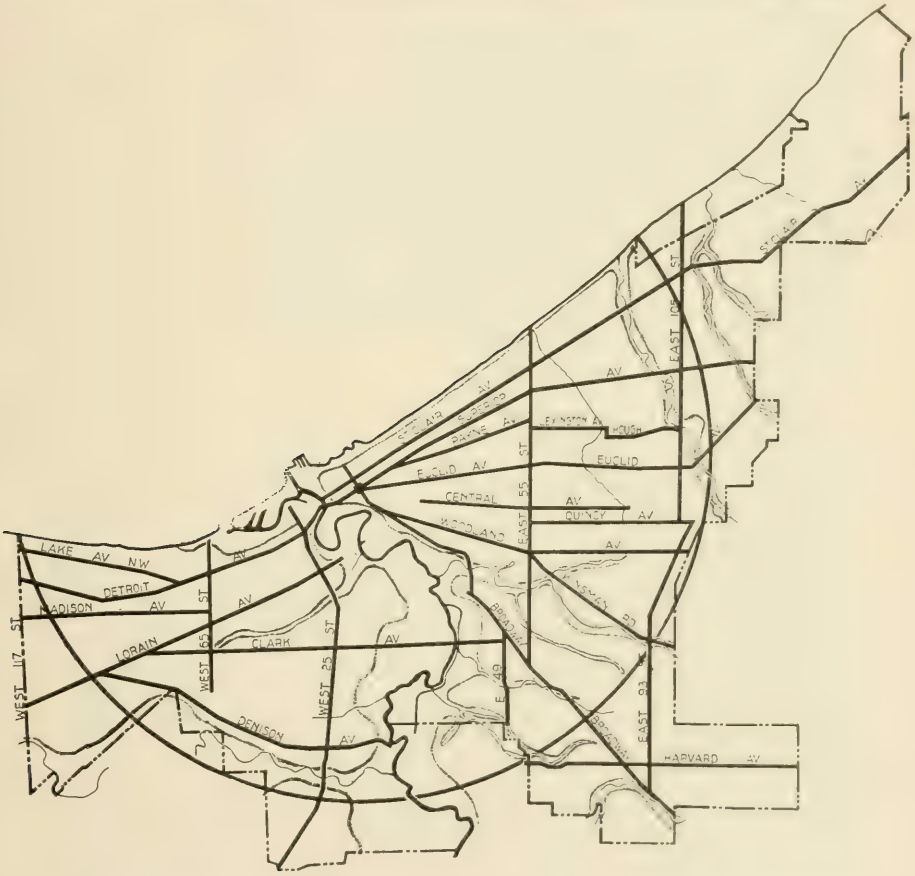
Boston's system of transit is a unique one, for in addition to its elevated railway, it operates many of its ordinary surface cars in subway terminals. They are now engaged in that city in constructing several additional subway lines, to be used in connection with surface cars.

Other American cities, which are considering subway rapid transit as a solution of their transportation problem, are Pittsburg, Cincinnati, St. Louis, Baltimore and Toronto.

From this we see that of the four cities, which are larger than Cleveland, three have met the problem by providing in addition to the street cars, operated wholly upon the surface, some form of rapid transit, either above or below the surface, or both,

while the fourth, Boston, has resorted to a scheme of subway terminals for its surface cars in the down-town section.

Having stated as briefly as is possible the conditions which exist in the four largest American cities, it is proper to examine the cities themselves in order that we may determine whether there is any fundamental difference between them which would affect the problem and which would have an effect in applying the results of their labor to our own city. The two great factors which interest one when addressing himself to this problem are, first,



the size of the city in point of area and population and, second, its shape and the opportunity which it has for growth.

As to size, it is at once apparent that the larger the city the greater the need of rapid transit. When considering the question of size, however, as affecting the need of rapid transit, there is a second factor which demands and should receive as much attention as population, namely, area. It can readily be seen that if there exists in the midst of a city a great area of land, unfitted for residence uses, because of its topography, it will be necessary

for the inhabitants of that city to ride greater distances to and from the different points where they have interests, than if the city is closely built up. Because it is apparent that the closer people live to each other and to the different points of interest in their city, the less need there will be of conveying them to and from their destinations.

When we classify cities as to shape, we divide them into three general groups. These are, the "whole city," or a city which exists inland with no natural barrier to its expansion in any direction; the "half city" which is obstructed on one side by either a large body of water, a mountain or some other natural barrier which allows the city to grow in every way but one, and the "obstructed city" which, by reason of natural barriers, is shut off on two or more sides from growth. We have no "whole city" which can be observed for the purpose of solving this problem, because, as a general rule, "whole cities" do not reach a size great enough to demand improved rapid transit.

New York is composed, practically, of two cities, Brooklyn, which is a half city, and Old New York, which has been free to expand only in one direction and which, under our classification, must be called an "obstructed city." Boston is shut in on one side by the Atlantic Ocean and on another side by the Charles River, and must also be classified as an "obstructed city".

Chicago and Philadelphia should be classified as half cities.

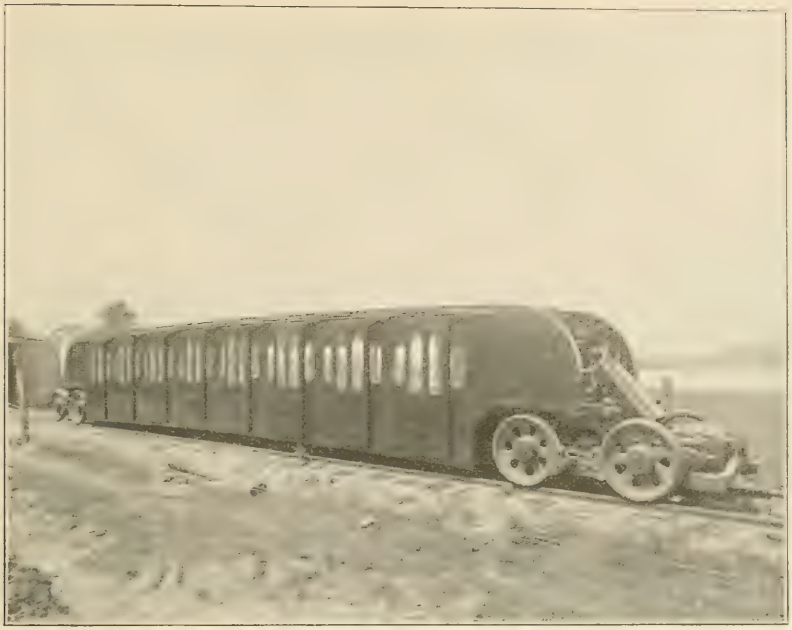
At first thought one would say that Cleveland is a "half city" and that so far as shape is concerned, it could be compared with some degree of certainty with other "half cities" of equal population. As to the transportation problem, however, this is not the case, because it cannot be compared with other cities, as to the transportation problem, without bearing in mind the large amount of land which lies in the midst of our city and which cannot, because of its topography, be used for residence purposes.

This topographical condition—wide and deep valleys, requires people to ride when otherwise they would walk.

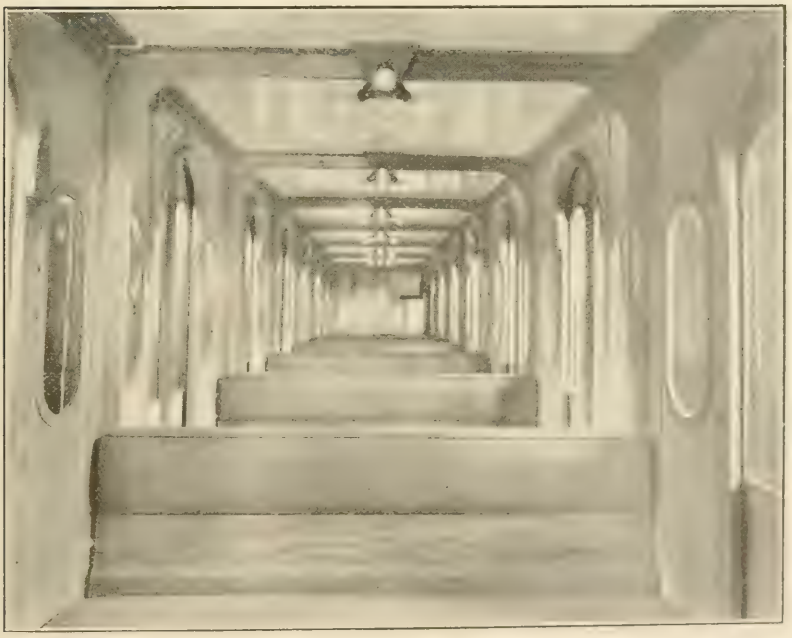
As a proof of this fact, probably the best figures that can be produced are found in the testimony of Mr. Horace Andrews, former president of the Cleveland Railway Company (given at the time of the appraisal of that company's property by Mr. Goff and Mr. Johnson), which figures show that the street railway earnings of Cleveland were 40 per cent greater per inhabitant per year than any other city of Cleveland's class in this country.

This should convince us that using the size of our population, exclusively, as a basis, is not a fair means of determining the needs of Cleveland for rapid transit; the fact is that the necessity for rapid transit in this city is just as great as it could be in a compact "half city" of nearly a million people.

I believe that it is wholly unnecessary to make any mention of the need of rapid transit in this city. The actual situation speaks louder than any words. The increase of 47 per cent in population, as shown by the last census, is only a forecast of what we may expect in the future. The number of passengers carried



The du Pont Subway Car.



Inside View of the du Pont Subway Car.

by the surface lines has been increasing at the compound rate of 8 per cent a year, according to the figures used in the Goff-Johnson appraisal.

I am informed by officials of the Cleveland Railway Company that the increase in the number of fares collected in 1910 over those of 1909 will be from 18 to 20 per cent. While this increase is remarkable, it is, however, not wholly due to an increase in population, but also to the use of pay-enter cars and the stimulation of traffic because of the low rate of fare.

The surface terminals of Cleveland, as at present arranged, are the most convenient of any large city in America and without them the number of cars now supplied at the rush hours could not be handled without blockades. The surface terminals, however, are limited in capacity and they cannot possibly care for but few more cars during the rush hours, while the future growth of Cleveland will require the operation of from 80 to 100 additional cars a year, with the same number of passengers per car as at present carried.

With the growth of the city and the expansion of its business section, street traffic becomes heavier. With the increase of other forms of surface traffic, the speed of surface cars, competing as they do for the right of way with all other vehicles, becomes slower. This means, in the final analysis, congestion, blockades and resulting bad service. With the decrease of speed of surface cars, a given street grows steadily away from the city's business center in point of time. As the speed of the conveyance lessens, the maximum time which people are willing to spend on the cars will carry them a less distance from the center. The increasing population will practically be confined to the present city limits. Artisans and laborers will be compelled to seek low rents in tenements, and all except the independently wealthy will be forced to live in flats. The solution is effective rapid transit.

Cleveland cannot furnish adequate transportation facilities by building additional surface lines to the business center, because there are no remaining avenues of approach. The problem, therefore, at once resolves itself into a choice between elevated railroads and subways.

Elevated railways are not desirable on account of being noisy and unsightly, and because of the damage to abutting property. Consequently, the only remaining method of solving Cleveland's transportation problem is the construction of subways.

By the time Cleveland's population is doubled, it should, in addition to its present transportation service, have a subway under each of its principal thoroughfares, terminating under the Public Square. There should also be built in every section of the city, outside of the three-mile circle, surface railways, crossing the main thoroughfares, approximately one-half mile apart as feeders to the subway. And when the city doubles its population a second time, there should be built an additional subway system under its main streets leading to the business center, the cars of which should not stop after leaving the business district until they have reached

the outer limits of the first subway system and thence, stopping only, at the stations of a second series of crossing feeder lines, approximately one-half mile apart.

This method could be extended indefinitely, because subways could be constructed below subways and fed by new crossing lines further and further out and as the newer subways could be operated faster and faster, all parts of the city would always be practically the same distance, as measured in time, from the Public Square.

Passenger transfers should be made at all convenient points between the different subway systems and between the different lines of each system and the existing surface railways.

The transportation problem of Greater Cleveland is not difficult to solve if judged in a spirit of broad- and fair-mindedness and measured solely by the standard of the city's best interests.

Joshua D. Varney.

Joshua Davis Varney, the veteran surveyor of Cleveland, was born in Brant, Erie County, New York, August 4, 1833. His parents were Vermont Yankees of the Quaker faith. In 1837, the family removed to Evans, where young Varney received his early education. He commenced to make surveys as early as 1850, but at no time, before he came to Cleveland in 1872, did Mr. Varney devote his entire time to Surveying.

Mr. Varney has never deemed it advisable to delegate the delicate tasks of his work to others, and has, therefore, confined his practice to such work as he could personally attend to. While regarding his work seriously, he makes no assumption of infallibility, and he is free from presumption and guile. He considers his work a public service, and, in it, is not influenced by regard for persons. He expresses his views with clearness, conciseness and force, yet without bitterness or passion. He is frequently called in consultation, and often asked to give testimony in court, where his extensive knowledge of land marks commands attention and respect.

Outside of his profession, Mr. Varney has but few hobbies. He is a student of philosophy, but does not brag of it, nor is he led away from his daily duties by this fact. He is kind, worthy, talented and useful; a man in whom the thought of service is greater than the thought of personal profit. Long may he remain with us.

Land Surveying in and Near Cleveland, Ohio, 1872 to 1911

The Tools Used and the Methods of Using Them.

By J. D. Varney, C. E.

My first work as a surveyor in Cleveland was in the spring of 1872, in the employ of Aaron Merchant, an ex-County Surveyor. I remained with him until his death in 1875, and with his son, Charles C. Merchant, until 1876. Mr. W. C. B. Richardson was also in Mr. Merchant's employ.

John M. Ackley was then County Surveyor and had in his employ E. Squire, C. H. Burgess and T. E. Towle. The following other persons were then living and were at that time or had been in the business:

Geo. E. Hartnell	Geo. A. Hyde	Lucius Dean
John H. Sargent	Chas. A. Walter	H. Haskins
J. C. Saxton	J. L. Sterling	J. R. Currier
John D. Crehore	W. H. Knapp	J. B. Fulkerson
Chas. D. Bishop	Schuyler Oviatt	Stephen Forbes

All surveyors were using Transits. Mr. Merchant owned, and occasionally used, an open sight Jacob Staff Compass, and although I used a transit, I followed his and my own previous practice and trusted to the needle in some cases. The open sight Jacob Staff Compass was useful when the country was new, and it probably still has a useful place. Better work can be done with it in woods than with a transit, unless more time is taken for the transit work. Thirty rods, or about 500 feet, is a long sight for lining with open sights on open ground in the most favorable light, but among trees, obstructions requiring offsets are lamentably frequent, and, though the statement may be disputed, offsets do not vitiate the alignment and their frequency tends to reduce errors, while errors in transit alignment are cumulative.

A Cleveland Surveyor, Mr. J. B. Davis, has invented and patented a Solar Transit, which appears to have advantages over others in the market, but the practice of Cleveland Surveyors indicates a belief that while the sun serves some very useful purposes, it is not so useful for preserving lines as stone monuments buried under, but near the surface of the ground.

For measurements of acreage property, Merchant and others used the Gunters Chain, which is 66 feet long and has 100 links, though I and some others used a 100-foot chain. With 50[illegible] wearing surfaces and 200 small rings to become oblong, a chain is sure to increase in length, and, though we occasionally made tests

and allowed for the excess, later careful measurements usually disclose a surplus over chain measurements.

For valuable city property and all subdivision work, two poles were used, each 20 feet long, with brass sockets at each end for protection. The foot marks were brass screws, and the 5-foot points were marked by the middle one of three screws, while inches were measured with a pocket rule.

One of our members, Mr. G. A. Hyde, tells me that while he was City Engineer, in 1856, he constructed a set of poles, and believes they were first used here about that time. At the present time, all principal measurements are made with steel ribbons, 100 feet or more in length. Some are graduated to feet only, in which case they are called "band chains" or "chain tapes." Some are graduated to 1/100 of a foot, in which case they are called steel tapes. The figures on the steel tapes require a wider ribbon and some of them are ½ inch wide, but nearly all are now using tapes ¼ inch wide. I claim to have been the first surveyor in this City, and possibly in the United States, to use this width of tape. Becoming dissatisfied with the wider ribbon, I applied to the Chestermans in England, who sent me several samples of ribbon from which I selected this, and on my order they sent one which I am sure was the first ever used here. This was about the year 1886. I continued to purchase from the Chestermans until the Lufkin Rule Co., of Saginaw, Mich., commenced manufacturing them.

The evolution from Gunters chain and the poles, to steel tapes, has been through the forms of 100-foot chains, band chains and chain tapes, tapes divided into feet and inches, feet and inches on one side and links on the other, and finally to tapes, divided decimally, and records of work in our note books and in recorded deeds have followed a little behind the units used in the field. Architects are using inches and sometimes ask us to use them on our maps. What the future may have in store for us we cannot know, but from the French metre, "Good Lord deliver us".

In using chains, the ends were marked with metal pins, which were also used as tallies. Effort was made to measure in horizontal planes, but plumb-bobs were not used. Vertical lines were determined by the eye, or sometimes by dropping a pin or stone. It is only fair to say that Merchant, with the helpers he had educated, made much better measurements than I could make by such methods.

When I was about to commence using the poles, Mr. Merchant told me of a former employe who made accurate measurements rapidly. Let us assume that the ground is level. The forward end of the first pole is placed in line with the rear end at the zero or initial point of the line; it is most convenient to do this by resting on one knee. You then rise quickly and, with the second pole in hand, walk or run rapidly 20 feet, then kneel, place the forward end of the second pole in line, and draw the rear end back by the side of the first pole. If you attempt to place the ends directly in contact, you are liable to move the first

pole. You move the second pole forward until by an aside movement you can bring the ends in contact. When you have repeated this process fifty times in measuring 1,000 feet, you find it pleasant to sit on the sharp edge of a fence rail to figure up and learn how the measurements check. You can move rapidly and cause your blood to flow rapidly, but measuring rapidly and accurately is another proposition, whether you use poles, chains or tapes—especially poles.

Plumb-bobs were used on uneven ground, but it was necessary to support the pole in the middle, or the sag would vitiate the measurements. Much may be said in favor of poles for accurate measurements, one strong point in their favor being that the effects of temperature and moisture on their length are negligible quantities. Those subdivisions, which were made with poles, generally show accurate work. If tapes had not been introduced, the changes in transportation would have forced a change. Until later than 1890, we kept horses and vehicles to transport our tools. Trolley cars now reach nearly all parts of the county, but they have no place for 20-foot poles, and there have been threats to exclude our line rods.

The records of the work done by Ahaz Merchant and his son, Aaron, seem to justify especial notice of them among the early surveyors. Neither of them lived to what may be called old age: Ahaz, 68 years, 1794 to 1862; Aaron, 58 years, 1817 to 1875.

Our Recorder's office shows a very large percentage of the recorded surveys previous to 1875, signed either by Ahaz or Aaron Merchant, and we know that a large part of their work was performed among forest trees on land, now covered with paved streets, and brick, stone and frame buildings. We find their work is of a high order, and the surveyors of today recognize this fact. Evidence that they had the confidence of the people is found in the fact that during the 65 years from the organization of the county in 1810, to 1875, the father and son held the office of County Surveyor 30 years. A list of the incumbents will show this and will be of interest here.

Until 1832, they were appointed by Court and the incumbents were:

S. S. Baldwin	1811 to 1823, inclusive,	13 years
E. Foote	1824 to 1828, inclusive,	5 years
Ahaz Merchant	1829 to 1833, inclusive,	5 years

After 1833, they held by Election and the incumbents were:

Ahaz Merchant	1834 to 1836, inclusive,	3 years
W. R. Coon	to 1839, inclusive,	3 years
W. H. Knapp, two terms	to 1845, inclusive,	6 years
Ahaz Merchant, two terms	to 1851, inclusive,	6 years
J. C. Saxton	to 1854, inclusive,	3 years
Aaron Merchant, five terms	to 1869, inclusive,	15 years
John M. Ackley, two terms	to 1875, inclusive,	6 years
		65 years

Between 1860 and 1870, the population of Cleveland increased from 43,000 to 93,000. Real estate values rose correspondingly, and it is no discredit to the Merchants to say that the time had come for a higher grade of work. Mr. Ackley realized this, and with the same tools, he had commenced to do a higher grade of work and was demanding it from those in his employ.

Well do I remember the first description in a deed in which I noticed seconds were used in giving the bearings of lines; it was made by an employe of Mr. Ackley. Since then I have made some effort to keep up with the procession, but at that time I thought it was an assumption of accuracy, which was not attained in fact.

Exactitude is not attainable. An error of 1/100 of a foot may express itself in a value of from less than one cent, to more than $20.00. Land values are rapidly rising in this City. If a skyscraper is to be built, it is important that all the land shall be utilized; it is more important that it shall not become an encroachment. Habits are so easily formed that it is dangerous to do anything but the best we can, where property rights are affected. Knowing, however, that exactitude is not attainable, we may discuss the question as to how large an error may be ignored. By what rule shall we determine this? When we are making original surveys, that is, surveys by which property is to be conveyed, if we do our duty, we will leave monuments to govern the distances, and law-suits are not likely to grow out of our work. In such surveys we may, with propriety, compare the value of the land affected, with the value of the time required to reduce an error, but when we are locating land previously conveyed, law-suits are liable to result, in which case the value of the land is but a small factor in the problem.

COMPARISONS OF MEASUREMENTS.

Quincy avenue, S. E.

E. 55th street to E. 71st street. 1 to 4.

1	Ahaz Merchant	1836	3349.5
	C. A. Walter	Apr. 1876	3357.7
2	Geo. E. Hartnell	1867	2480.52
	C. A. Walter	Apr. 1876	2481.40
3	Ahaz Merchant	1858	610.00
	J. D. Varney	1910	611.20
4	C. A. Walter	Apr. 1876	826.30
	J. D. Varney	1910	826.90

CHAMBERLIN AND SOUTHERN SUBDIVISION 5 AND 6.

Hawthorne avenue, S. E.

5	C. H. Burgess	1881	1799.80
	J. D. Varney	1903	1799.83
	C. H. Giessen		1799.80

Longfellow avenue, S. E.

6	C. H. Burgess	1881	1096.68
	J. D. Varney	1887	1096.76

East Ninth street.

St. Clair avenue, N. E., to Hamilton avenue, N. E.

7	C. A. Walter		1878	307.42
	E. B. Wight		1910	307.49
	W. H. Evers		1910	307.51
	J. D. Varney		1910	307.59

South Line, Euclid avenue.

E. 30th street to E. 46th street.

8	Seth Pease		1798	3300.00
	Geo. Culley			3322.12
	C. W. Root	Oct.	1892	3322.10
	E. B. Wight	Feb.	1909	3321.66
	J. D. Varney	July	1887	3321.25

Euclid avenue.

E. 6th street to E. 9th street.

9	C. C. Merchant			1002.98
	J. L. Culley			1003.14
	G. M. Garrett		1901	1003.18
	C. H. Burgess	Mar. 27	1895	1003.34
	S. J. Baker		1899	1003.46

E. 70th street.

Central avenue, S. E., to Cedar avenue, S. E.

10	J. F. Brown		1889	1508.07
	J. D. Varney		1891	1508.13

There is some uncertainty in No. 1, because the stones to which Walter measured were set after the Merchant survey. Merchant used a chain; Walter used a tape. In No. 3, Varney used a stone at the east end, set by Merchant, and a stone, set by Hartnell, at the west end. Merchant used poles. In No. 8, the monuments used by the others were set after the Pease survey. Pease probably used a Gunter's chain. The others used tapes.

Between 1872 and 1880, steel tapes came into use, making better work possible, and their usefulness was greatly increased by Mr. Clarence H. Burgess, who made a careful and thorough study of the effects of strain and temperature, and was the first among us to procure from the United States Coast and Geodetic Survey Department, tests of tapes, 100 feet long, in place of the tedious and necessarily inaccurate method of comparing with the standard yard in the custody of our County Auditor. It is quite probable that if Mr. Burgess had not been among us, we would have learned to do this, but—but—it is also probable that some other person would have learned what lightning is if Franklin had not gone kiting. It is, of course, true that strain and temperature apply to chains as well as tapes, but their other inaccuracies are so great that to have considered these would have been an absurdity.

There were others who contributed to this improvement; one was, Chas. A. Walter, the assistant, who had charge of Street

Surveys under Chas. H. Strong until Walter's death in 1887. He strove to set a good example in accurate work, and more than this, during his official life, the power was placed in his hands to enforce better work in making subdivisions. See Rev. S. of Ohio, Sec. 2601, and Rev. Ordinances of City of Cleveland, 1890, Sec. 1076, page 363. Previous to these enactments there had been some vague requirements as to what a subdivision map should show, but there was no tribunal to determine whether they conformed with the requirements. There are maps on record, made by land owners without the work of a surveyor; to this I do not object, but that is another matter. Under these State and City laws, the City Engineer was upheld in demanding better work, and the standard of work in general was raised.

When the angles of a survey are determined by courses derived from the magnetic needle, it is appropriate that the compass card shall be graduated only to one-half degrees, from which one-quarter degrees can be estimated. Finer graduations would not have been useful. The Traverse Table is appropriate for calculations based on such field work. The transit which Aaron Merchant was using was bought and used by his father, Ahaz Merchant, and the public record of his work indicates that he, Ahaz, used the trigonometrical tables and possibly logarithms. It is, however, true that in his private notes the only calculations I recall having seen were in the form of traverse table calculations which Aaron Merchant used for all his work, including that based on the finer angles derived from transit readings. His method was to use the one-quarter degree above and below the given angle and then interpolate.

The most important part of our work is marking lines and corners. A discussion of this subject necessarily takes us back of 1872. The method of marking lines by surveyors of the Moses Cleveland times, had become nearly obsolete before 1872, though many of the lines marked then remained, and possibly some of them still remain.

My experience on the Holland Purchase of Western New York helped me to understand what I found here, and what I have learned here has given me a better understanding of what I met with there. The original surveys there and here were mainly made through forests, with needle courses, checked occasionally by observations of the North Star. The corners were usually marked by stakes, from which measurements were made to nearby trees called "Witness trees".

The lines between the corners were shown by marks on trees. When the compass line struck a tree, it was marked with what was called "three hacks and a blaze", *i. e.*, the axe man would strike the tree in three places, one over the other, each time cutting through the bark. Above this he would blaze the tree, *i. e.*, he would shave off the darker outside bark, exposing the lighter colored bark or wood so it could be easily seen. These "blaze" marks" were to assist purchasers, or prospective purchasers, to find the lines. Trees marked with three hacks and a blaze

became legally "line trees", even when later surveys showed they were *not* in the line. Adjacent land owners were joint owners of valuable line trees. Besides the line trees, other trees near the line were "blazed" to assist in finding the line trees, corner stakes or other monuments, but they had no legal effect in locating the line. When stones were found near lot corners, they were piled around the corner stake, forming what the records call a "Stake and Stones."

Where stones are not easily found, it is often hard to decide what to use. I remember a case on the Holland Purchase where, while searching for a suitable monument, my assistant found a large bone, but my employer objected, saying he "wanted something permanent, and that the bone would be called for at the resurrection." I think we compromised on a hemlock knot.

While I was with the Merchants, we were using the last of a carload of stones which had been shipped to them from Berea, and I believe that such monuments are the best that it is practicable to use. Iron rods, gas pipes, drain tiles and other devices are used. Drain tile with a nail or spike in the ground under them do very well, but all such devices are inferior to good sand stone monuments, having a base of not less than 100 square inches and a height of at least 18 inches, set about 3 inches below the surface. I often set stones of less size, and believe they are better than any of the substitutes mentioned above. Corners of lots in subdivisions are usually marked with oak stakes.

The Merchants set large numbers of good stone monuments, and their monuments are valued highly by all later surveyors.

The surveyors know that every land mark which is accepted as authority is of immense value and is appreciated not only by surveyors, but by those who have indulged in expensive lawsuits.

There was one practice of Aaron Merchant, however, which was not commendable; he placed monuments at corners and offsets from lines, making no public record of the fact, thinking that his personal interests demanded such practice, and this leads to another phase of the subject.

In 1872, there was less friendly feeling between surveyors than there is now. The advantages of friendly intercourse which lead to the formation of the Civil Engineers' Club of Cleveland, did not then prevail. It is different now. With but a few regrettable exceptions, if one of us wishes for information which another has, we ask for it and it is cheerfully given. A wise selfishness prompts this, but selfishness is not always accompanied by wisdom. This friendly practice is well, but we must not censure Merchant. We must remember that he had notes of 50 years' practice, and there was no one who could offer an exchange on equal terms. While I do not have much knowledge as to the practice in other places, I do know enough to make me feel proud of this part of the Cleveland practice, and to make me sure that Merchant's methods are the rules in some other cities.

This paper was commenced in response to a request by your former Secretary, who believed that an account of the changes,

which have occured in the tools as well as practice of surveying during the last 39 years, would be of interest. Possibly about the year 1950 some member may be asked to speak of the changes which will have occurred between this and that time. Possibly they may then have better instruments for alignment and measuring angles than those we now have, but I doubt their having any with a higher degree of accuracy than those now made by our J. C. Ulmer Co. and other manufacturers in the United States. They may have a better tool for measuring than a steel tape, but I doubt it. If better tools come into use, it is probable that specimens of those we now use will have been preserved, but for our methods of using tools, they will be dependent on what is written and what can be told by those among them then who are active now, and for those who may feel an interest in the subject, I will now speak of our methods.

In measuring angles, we repeat and divide to determine the smaller fractions. While our transits have needles, we use them but little, and that little is mainly to show lawyers and courts how unreliable they are.

All use steel ribbons for measuring, and I believe all use those which have been compared with a government standard. Nearly all, and probably all, take account of strain and temperature. Some of us have tapes which have been officially tested and use them only to test other tapes. We differ some in our methods of testing tapes, and also in our methods of measuring. I know more about my own methods than of the methods of others, so will be egotist enough to speak of them.

It must be stated here that my methods have often changed and they may change again. I know this statement would be true of some of my associates and believe it is true of all, for I believe all wish to use the best methods, nevertheless, strange as it may appear, some fail to see that Varney's latest method is always the best method.

The government certificate, accompanying the tape I use for testing, shows it to be correct at 28-1/3 degrees Fahr., with 10 pounds strain supported, that being the strain usually used by the Government when testing. From this I learn that the tape I use in the field is correct at 41-1/3 degrees Fahr., with 20 pounds supported and 25 pounds suspended. When measuring, I depend on my muscle for 25 pounds strain, and only occasionally use the scales. Mr. H. W. Bill tests at 10 pounds suspended, and always uses the scales in measuring. The only objection I see to this is the uncertainty when he measures less than 100 feet. He measures the even one-hundreds with a band chain and uses a tape for the fractions of one hundred. I have made some experiments and failed to detect any difference between measuring 100 feet at once, or in two parts of about 50 feet each, using in each case what my muscle called 25 pounds. Mr. E. B. Wight tests at 10 pounds supported and finds that with 17 pounds suspended he gets the same, and he always uses the scales and 17 pounds. This leaves but a small chance for error, and is a better method than

mine. The higher the strain used, the less error there will be with varying strain, and with using part of the tape. Fearing some may criticise me for depending on my muscle, I wish to argue the case.

I have a precedent in the practice of one of the 1872 surveyors. It is said that a unit of measure, which he sometimes used, was the distance he had learned he could throw a stone of a given weight with a given amount of muscle.

For many years I have used tapes made on special orders only and differing from those in the open market; differences which have not increased the cost to me and which would probably decrease the cost to manufacturers, if made in large quantities. The most important difference is that the 0.01 graduations extend 0.40 beyond the 100 feet. Another is, I do not use a reel. Another is that there is blank space at both ends of the tape. Another is that at each end of the tape I have large brass rings which are not used as rings, but as hand holds to get the required strain.

By having the zero some distance from the end, I lose the advantage of the square shoulder of other tapes, against which the plumb line is held. This I remedy by placing a quantity of solder over the zero, into which I cut a slot for the plumb line.

Speaking of the plumb line tempts me to digress and talk of the value of that ancient tool. Ancient; it is probable the plumb-bob was an ancient tool when the first pyramid existed only in the imagination of an ambitious Pharaoh, and today, besides its use in other branches of engineering, it is indispensable for the surveyor who wishes to do accurate measuring, and for alignment it is to the line rod what the spider line in the telescope is to the slots of the open sight compass. If I were a poet, I would attempt a song in praise of the plumb-bob to be sung by surveyors.

For placing a point in line, I never depend on the line rod for close work, unless the transit man can see the point of it, and it is an exception to the rule when the point is sharp enough even for this. The plumb line, or the transit (transit preferred), is used for fixing targets over points to be used for alignment. For points in line, a point near the line is fixed and tested with the plumb line, and other points are tried until the "all right" signal is given.

It is less difficult to measure to a point than to measure a given distance. I act on this maxim both for all of a long line, and for each 100 feet. Call the man at the zero end *A*, and the other *B*. If the ground is not level, *B* should be on the lower ground. *A* gives the line and *B* fixes a point to be measured to at a distance of a little more than 100 feet, and here is the advantage of the 40's graduations beyond the 100 feet. The tape must be used as it is tested, that is, it must be suspended. *A* holds the zero at the initial point and *B* experiments with varying lengths of plumb line until he has the shortest distance, which is at once noted; it is always 100 feet or more, and not more than 100.40. It is less trouble to find this shortest distance by the marks on

the tape than by the marks made on the ground. If necessary, A may use a plumb bob with short line, but it is dangerous to use the plumb bob at both ends. If a long line is required, it is better to measure in the opposite direction. When the whole is measured, additions are made, the thermometer is consulted and plus or minus additions are made for temperature for the true length of the line. Some enter the temperature in the notes and make the corrections in the office. This is better under some circumstances, which do not often occur with me.

Looking to the future, we need a standard measure in some easily accessible place, on which to test tapes. Several of us have tapes which have been tested, and we keep them for testing purposes. There are several buildings in the city where there is more than 100 feet of floor space, which we are kindly allowed to use, but there should be a place where we would have a right to go and where there would be a standard provided with such appliances as we are now forced to improvise. If our County Officials would provide a steel bar, 100 feet long, with the proper appliances for testing, United States Officials will, without charge, test and place on it the proper marks, by which tests can be made. This statement was true a few years ago, and probably is true now. This should have been provided in our new Court House, but it is probably too late now. Some of us have examined the plans and find no available space for it.

Another thing is needed in the interests of the profession, and more in the interests of the public, and that is the care of land marks, especially in the streets. I became quite well acquainted with the afore mentioned C. A. Walter and I have been quite well acquainted with each of his successors, and I believe that each of them, without exception, has tried to do his duty, but in some way monuments have been lost every year.

The powers above the street surveyor do not over-estimate the importance of pavements, sewers, public buildings and even such trifles as viaducts and street car service, but I do believe they under-estimate the importance of land marks or they would never give a permit for any work liable to disturb them without first notifying the head of the street surveying department and giving him time and help enough to see that such monuments are cared for.

There is one phase of this subject, which it is difficult to speak of with proper respect for our law-makers. I refer to Section 2797 of the R. S. of Ohio, which should be repealed. The effect of it is to increase the taxes on land, because it is subdivided, but the amount so collected is much less than the expense in the Auditor's office, which would be saved if people would be encouraged to make subdivisions. This, however, is too large a subject to be discussed at the end of a paper, which is already too long, but I know what I am talking about when I say that no other subject has been introduced which is as important as this one.

Discussions

W. H. Searles:—

I have listened with interest to Mr. Varney's paper, describing the men, the methods and the instruments used in surveying in his early days. The improvements made in the construction of instruments in a single life-time are certainly remarkable. The solar transit upon the table before us is an apt illustration of this fact. Its many new features, compactness of parts and smoothness of motion are most admirable, and are designed to secure the most precise results with the greatest facility of operation. Yet this modern instrument is based on the same principles as the original solar compass with its plain sights, invented and patented by William Austin Burt, in 1836, and used by him for years in surveying the public lands in Michigan. However crude that instrument may now appear by comparison, we honor the inventive genius of the man who designed it, and regard the instrument itself with a certain awe, as we do the first locomotive of a century ago—the fore-runner of our present powerful road engines. Burt's original solar compass is now treasured by a grandson of his sister, Mr. George Quantrell, who lives at Decatur, Michigan.

It is a satisfaction to reflect that the apparatus of the surveyor and engineer has kept pace in improvement with other lines of scientific and mechanical work. Having such perfect instruments at hand for measuring either angles, or horizontal or vertical distances, it would seem that there should be no excuse for inaccurate results, but we find it true in engineering as in the army and navy that everything still depends upon "the man behind the gun". Too often it happens that the assistant, relying on the perfection of his instrument, grows careless in his manipulations and introduces errors that should not exist in the results. The rush and haste of modern practice seem to preclude the use of those checks and precautions which insure accuracy; the older generation of surveyors seemed to have more time at command. Now that every kind of instrument has reached a high degree of perfection, it is logically in order to train the man to match, giving him a thorough acquaintance with all its parts, its liability to injury, and the precautions necessary to give the best results.

W. R. Warner:—

Mr. President and Gentlemen:—

Mr. Varney's very interesting paper calls to my mind some incidents in connection with high-grade surveying, which is the basis of all our surveys—namely, the position of the heavenly bodies which guides us in determining our location on the earth. Mr. Varney mentions the errors incident to all instruments, and the thought that comes to me is the method that the Royal Astronomer at Greenwich adopted in attempting to eliminate instrumental errors about 60 years ago.

It has always been customary in the use of fine astronomical

instruments to determine the errors as closely as possible and then make allowance for them in computing the results. Sir George Arey, the Royal Astronomer at the time mentioned, conceived the idea of constructing an instrument which would be free from all instrumental errors. His method was to erect a perpendicular tube, solidly mounted on the rock foundation. At the bottom of the tube was a concave reflector, and near the top was placed a telescope objective, the reflector and objective being about 10 inches aperture. Near the top, just under the objective, was placed a right angle prism, taking the rays of light to the eye piece at the side of the tube. The telescope thus mounted was called by him a Reflex Zenith Tube. Of course, one could observe only zenith stars, but there are a sufficient number that would pass the zenith to serve his purpose. Observations, as you will readily see, were made by looking in the eye-piece at the side of the tube, and the observer need never touch this telescope.

To the surprise of the Astronomer Royal, many errors were still manifest in his observations, and very curiously they were variable, while he naturally expected that if any possible errors were left, they would be constant. He made a long series of observations, all of which manifested errors, and his improved form of instrument was finally declared a failure and consigned to the Royal Museum of obsolete instruments, and his observations made with the instrument were preserved in the Library of the observatory.

Let us now pass over a period of 50 years to the observations of Professor Chandler, of Harvard Observatory. Astronomers had, for a long time, suspected that the pole of our earth wobbled slightly in its yearly journey round the sun, and by Professor Chandler's careful observations a slight variation in latitude was not only observed, but carefully measured and tabulated through a series of years. It then occurred to him to compare his observations with those made by Sir George Arey with his Reflex Zenith Tube 50 years before. He visited England for this purpose and by comparing his own observations with the ones referred to, he found that the errors coincided very closely, thus establishing as a fact, that the supposed instrumental errors in the old instrument were only variations in latitude caused by the irregular motion of our earth.

Professor Doolittle, of Flower Observatory of the University of Pennsylvania, was so interested in this that his Observatory ordered an instrument made on the same lines as the one designed by Sir George Arey 50 years before, and he is now using it in all latitude observations.

It is interesting to note that the discovery of the variations in latitude by Professor Chandler theoretically make a periodic change in the line dividing the United States from British Columbia. This international line runs along the 49th parallel of latitude, and is, of course, authorized by convention and established by monuments so that the line itself is permanent, but if we consider that the 49th parallel of latitude is the line between

the two countries, its variation is such that the ownership of a strip of land, 60 feet wide and 3,000 miles long, will alternate between the United States and British Columbia. The line having been established by the Governments and marked by monuments, no real change of ownership occurs, but theoretically considered it is an interesting point.

A curious incident occurred in the recent re-survey of the line between these two countries, for the surveyors found the line running directly through a mountain of difficult ascent, so they were compelled to go round the mountain by a system of triangulation. On reaching the other side, they found that the line did not correspond with the previous survey, and thinking they had made an error, they surveyed it again, only to get the same result. It then occurred to them to go round the other side of the mountain, and the result of this course made clear the fact that the attraction of the mountain threw the plumb line and level out of true, causing the error referred to.

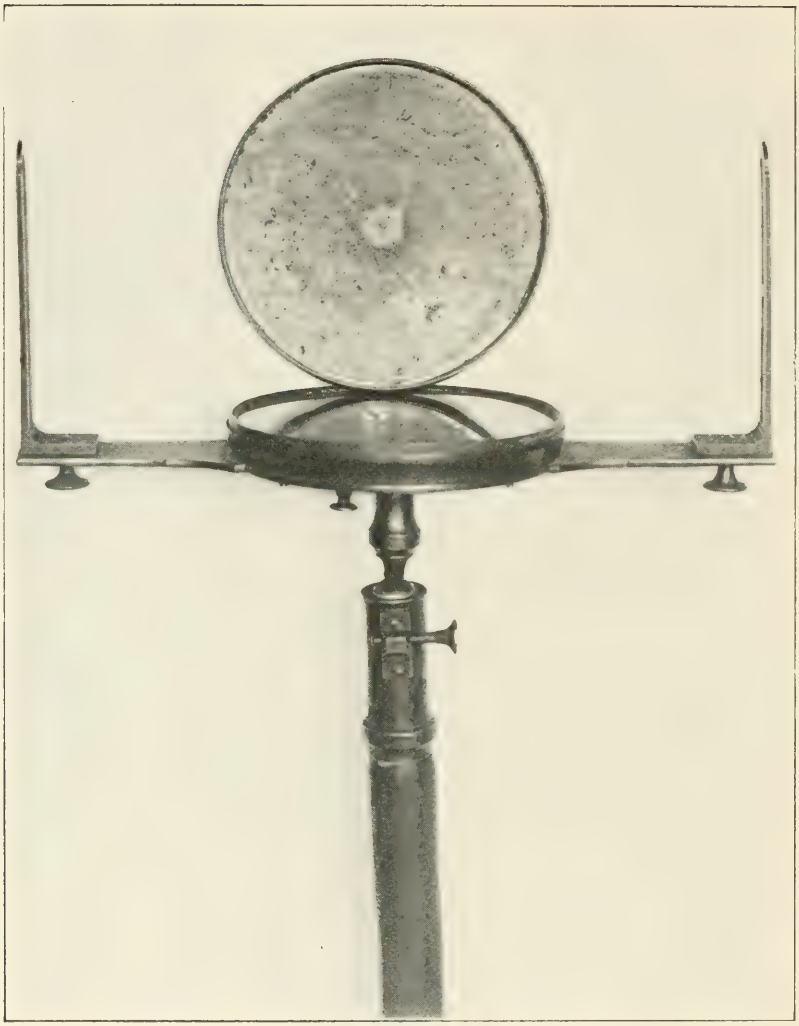
These items serve to illustrate a few of the many curious incidents that will be brought to your minds by Mr. Varney's interesting paper.

Hosea Paul:—

I have brought here tonight three things to show you. The first is an old-time compass and jacob staff. On the plate you will see the name Rittenhouse & Shower. Whether this was David Rittenhouse, to whom Surveyors owe so much, especially for the rectangular system of computation, I cannot say. I am of the opinion that the compass was made at Philadelphia or Lancaster, early in the last century, or possibly before. It was found among the effects of J. T. Holloway, of Cuyahoga Falls, Ohio, after his death, some 30 years ago. One of his sons now lives at Akron, Ohio, and another was Josephus F. Holloway, a man of many accomplishments and of infinite personal charm, who was a Past President of this Society.

The elder Holloway came from Pennsylvania, and after a short stay at Uniontown, Stark County, settled at Cuyahoga Falls, Ohio, in 1831. The compass shows but slight wear, and I am quite sure that Holloway made very little use of it. The plate was leveled by the needle, as there are no bubbles for this purpose, nor is there any slot in the staff, or clamping screw to hold the compass in position; yet I am of the opinion that very fair work might be done with it.

I learned to use a compass quite early in life from my father, who was the surveyor of Summit County. Handling a compass properly was quite an art. In carrying it along over the shoulder the glass cover sometimes became electrified by rubbing against the clothing, and when the compass was set up, the needle would be found sticking to the glass. A way to dislodge it was to apply a moistened finger, or to breathe upon the glass. On one occasion, when making use of this latter expedient, I was closely watched by a witty rustic, a fellow we would now call a *"Rube"*, who said,



Jacob Staff.

"see him whisper to it." We also looked around for axes and chains likely to affect the needle and had them removed to a safe distance, watched the swing of the needle closely, and if it seemed to stop too suddenly, would set it in motion again by tapping the staff or swinging the sights. I may be mistaken, but it seems to me that those compass needles were of better quality than we find in our modern transits; at any rate, they were not subject to the influence of electric wires.

The needle, in those days, was something of vital importance, and we learned to study its actions and its humors. For the practical use of the open sights, however, I was somewhat hampered by shortness of vision. Some years ago, in Pennsylvania, I retraced

Nath. Mills W. Betts' Book bought augt. 1823 from Henry Thorndike Esq.

A

SYSTEM

OF

GEOMETRY AND TRIGONOMETRY:

TOGETHER WITH A

Treatise on Surveying;

TEACHING VARIOUS WAYS OF TAKING THE SURVEY OF A FIELD; ALSO TO PROTRACT THE SAME AND FIND THE AREA.

LIKEWISE,

Rectangular Surveying;

OR,

AN ACCURATE METHOD OF CALCULATING THE AREA OF ANY FIELD ARITHMETICALLY, WITHOUT THE NECESSITY OF PLOTTING IT.

To the whole are added several Mathematical Tables, necessary for solving Questions in Trigonometry and Surveying; with a particular explanation of these Tables and the manner of using them.

COMPILED FROM VARIOUS AUTHORS,

BY ABEL FLINT, A. M.

HARTFORD:
PRINTED FOR OLIVER D. COOKE,
BY LINCOLN & GLEASON.

1804.

Title Page, Taken from Flint's Surveying.

lines which had been run originally with a compass, and over these I ran transit lines, cutting vistas through the brush, using forward and backward sights, and I found that in many instances the marked trees and intermediate corners were in a perfectly straight course. This winter I again surveyed some of the same lines and found that in the meantime other surveyors had placed marks which would leave the line a zig-zag one, thus showing work inferior to that which has been done 60 or 70 years before.

The second thing I bring is a copy of Flint's Surveying, published at Hartford, Conn., in 1804. This work has passed through many editions, and was long regarded as a standard text-book. This particular copy seems, by the autographs, to have been the property of Henry Thorndike in 1823, very possibly a member of the family of the Boston merchant, who was the original proprietor of Brimfield Township, Portage County, Ohio. It then passed to Captain Nathaniel Mills Warham Bettes, a Revolutionary soldier, who settled in Tallmadge, Ohio, where his descendants are still living. He was one of the early surveyors, though I know of no work of his previous to about 1820. The book later passed to Enoch Woodruff, and then to his daughter, who gave it to me.

The third thing of interest is a flat ivory scale. It is turning yellow, and has been in possession of our family, I suppose, at least 60 years. The length of a line was not taken by laying the scale on the plat, but by placing the dividers on the scale and transferring it. There is also a scale of chords. It would seem that this could still be used to very great advantage if made of greater length and finer divisions. But as long ago as I began, we made paper scales by cutting up slips of paper and graduating them with stepping dividers. The triangular scale first appeared about 1870 and won instant favor, though I later learned to prefer the flat ones with beveled edges.

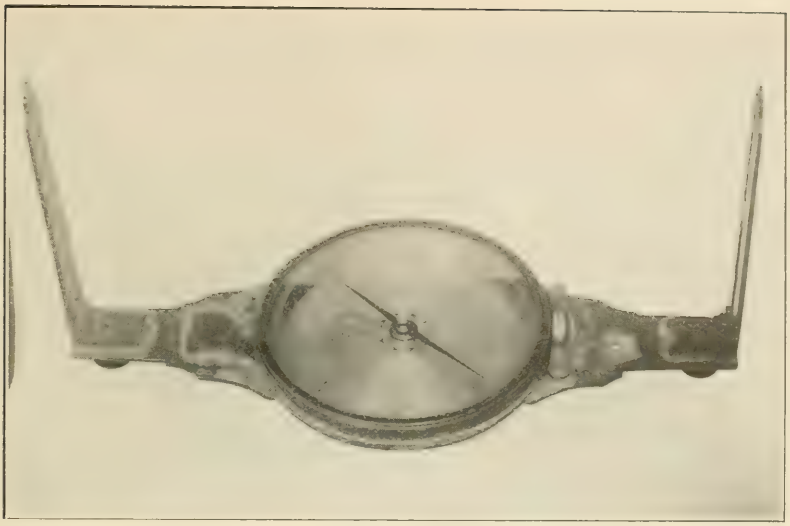
J. C. Ulmer:—

Mr. Chairman and Gentlemen:—My part of the discussion in connection with Mr. Varney's interesting paper will be on instruments and tapes, and some of the improvements made in those lines in recent years. The subject, however, is of such magnitude that a short talk like this must necessarily be of a rambling nature.

You will see here an old-time open-sight compass (see cut No. 1), which differs but little from those of the present day. It was made by Andrew Meneely, Troy, N. Y., and has been in the family of Mr. Ezra Nicholson for at least three generations.

This transit (see cut No. 2) was made by the late Mr. Young, of Philadelphia, Pa., father of the American Transit, and founder of the firm of Young & Son. It is at least 58 years old, and with it, many of the surveys of the old Atlantic & Western Railroad were made. The improvements, as you will see by comparison with the modern transit, have been marvelous.

This complete modern transit (see cut No. 3) gives little indication to the young engineer now commencing practice, of the



Cut No. 1.

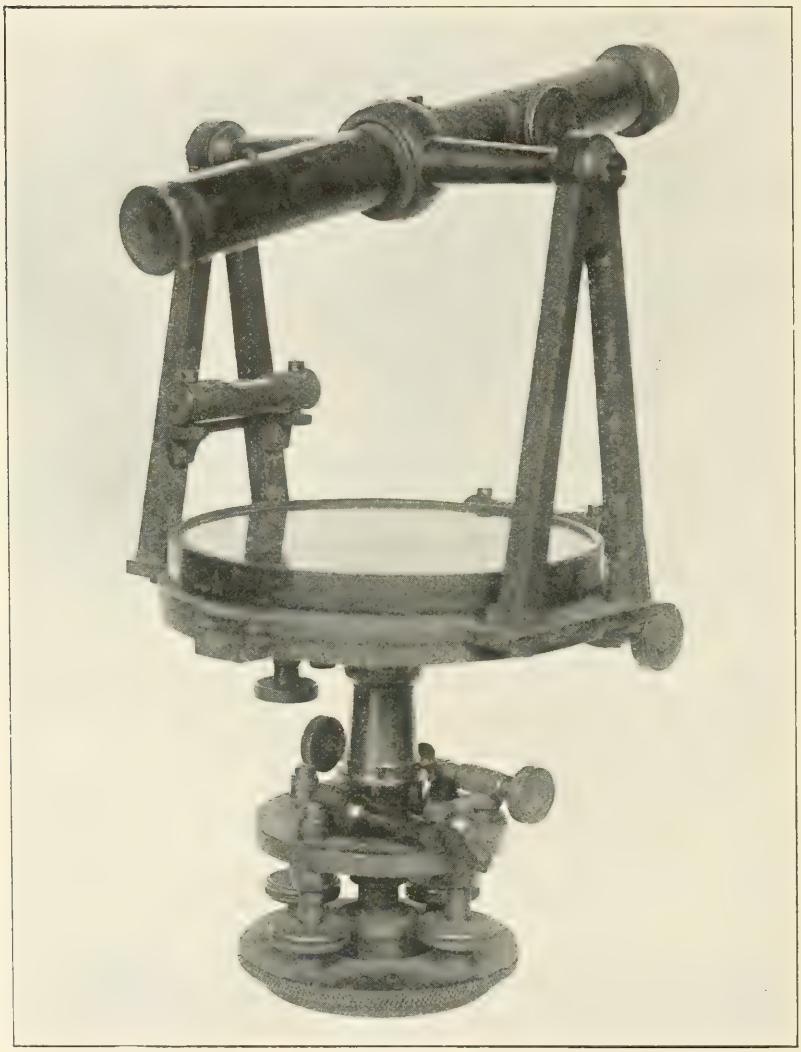
hours of study and mechanical skill required to bring it to its present state of *near perfection*, for perfection is impossible. Practically, you can accomplish with it any work within reason, but as Mr. Searles remarked, "the man behind the gun must be proficient." Almost anyone with a smattering knowledge of surveying can do good work with a transit like this, but it takes a man of experience, ability and ingenuity to get practical and accurate results from an inferior instrument, and this is the man who has contributed much by timely suggestions of things needed, to the instrument-makers' present state of *near perfection*. To go into details would require hours, and I shall, therefore, give but a few of the essentials.

Proper proportion of the various parts is necessary. (These usually differ according to the views of the maker.) The material entering into it must be wisely chosen, and especially is this true of the centers and sockets, which must be turned round and absolutely concentric. The standard plate, upon which the verniers are mounted, must be free from all strain. The horizontal circle must be well seasoned, and as free from casting strains before graduating, as possible, as the extreme changes of temperature the instrument is subjected to, which at times exceeds 150 degrees F., make this very imperative.

The telescope is also of great importance, but time will not permit me to go into detail at present, as it would require several hours to do so.

About a month ago, a customer, to whom we sold a transit in 1909, called on us upon his return from Canada and said that he did not see how we could build a transit that would hold its adjustment under the varied conditions that his had been subjected to. The transit had been shipped to California, where it was used

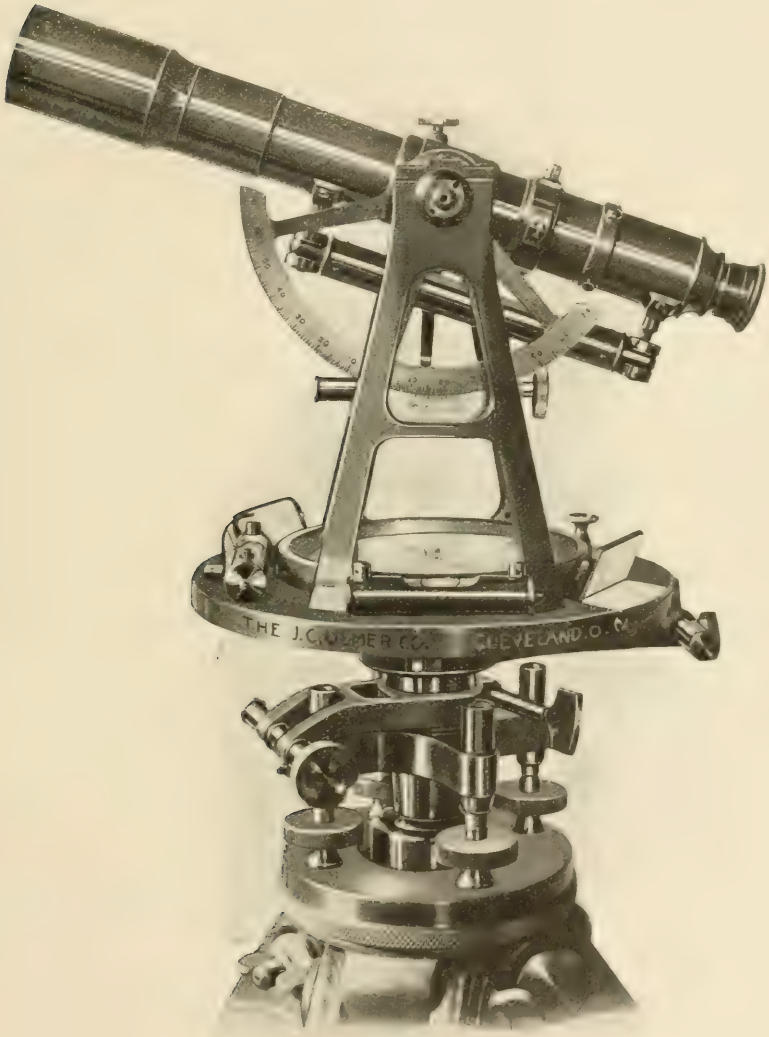
in the hottest weather, in the blazing sun, and from there to northern Canada, where it was used 34 degrees F. below zero, often on 5 feet of snow, and throughout it all, practically no readjustment was found necessary. Only this evening, one of our members came to me and said he was using a transit which had not required



Cut No. 2.

readjustment for more than a year, although it had been in constant use. Reports like this are not exceptional, and we could even give better ones; that they are very gratifying to the maker, however, goes without saying. This result has not been attained by our firm alone, but by nearly all conscientious instrument-makers

in the United States. By conscientious I mean those who have endeavored to supply the profession with the best tools that optical and mechanical skill can produce; who have, up to the present, escaped the rampant spirit of commercialism, and whose pride in

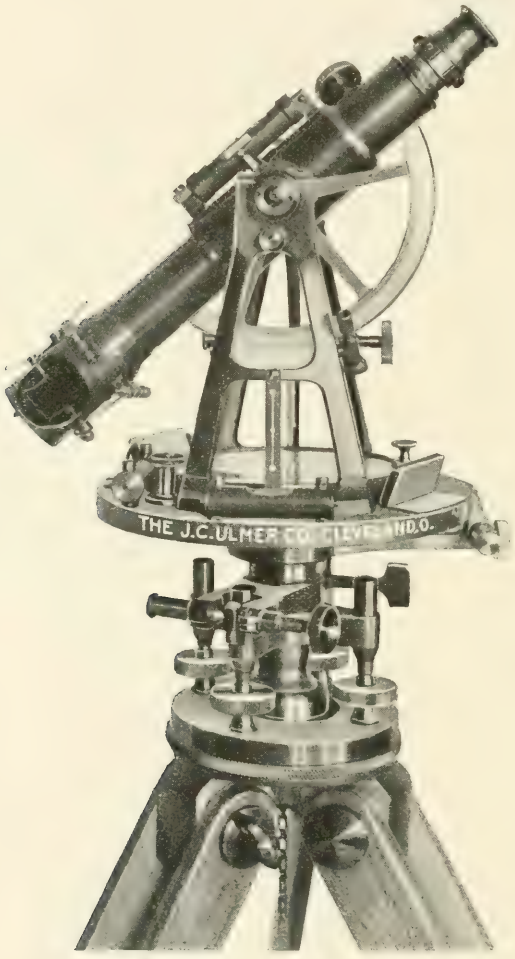


Cut No. 3.

the production of an instrument as nearly perfect as possible, is, in his or their estimation, of greater value than an extra few dollars, for *"right"* is their watchword, not *"good enough for the money."* A good transit cannot be built cheaply. The cost of the

material is of minor importance, compared with that of the skilled labor.

If you have trouble with your transit, don't lay it on the maker until you have determined that the fault does not lie with you. Remember "the man behind the gun". If you cannot rectify by adjustment, let the maker know; he will appreciate it. He has his troubles as well as you, and now and then (not often) an



Cut No. 4.

error is overlooked even with the closest inspection. We should all be willing to rectify mistakes; you know you have to, and the instrument-maker will, if given an opportunity.

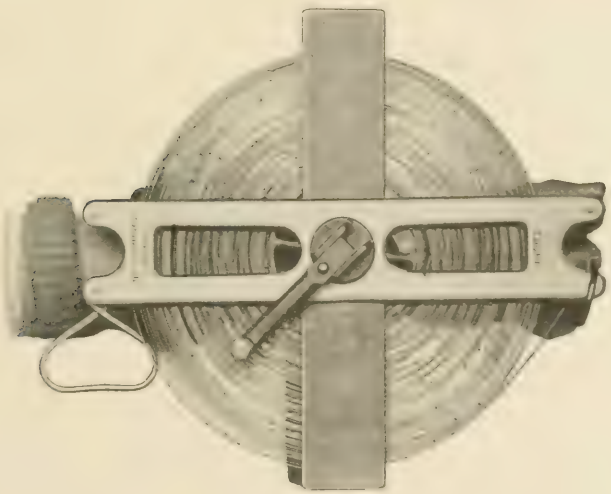
Here is a complete Davis Solar Transit (see cut No. 4), invented by Mr. J. B. Davis, of this city. The Davis Solar is, in the estimation of those who have had and are having the privilege of

using it, the most complete solar instrument made today. I will not dwell longer on this, for I hope the Program Committee will persuade Mr. Davis to give us a personal talk on the Solar in the near future.

This is an 18-inch engineers' level, made by our firm. It has a mirror attachment which enables the operator to level his instrument without change of position, or the help of an assistant. This is particularly advantageous where "snap" sights must be taken, as he can see the bubble with one eye and his rod with the other, or when used upon boggy ground or places of like nature. It is a time and money saver. This is a very old idea, but I believe that our method of attaching it is original.

Referring now to the measuring tools, you see here the old-fashioned chain (which still has its niche) with its 300 or more wearable joints, described by Mr. Varney, and the latest "instantaneous reading", etched pocket tape.

Last, but not least by any means, the Lucas Chain Tape, together with reels for tapes, 100 to 1,000 feet in length. The new folding reel (cut No. 5) for 200 and 300 feet lengths, is consid-



Cut No. 5.

ered especially good. We perpetuate the name "Lucas" because the late Geo. F. Lucas, of Castile, N. Y., himself a civil engineer, and of exceptional mechanical ability, found the tapes on the market in the early eighties of questionable accuracy and of inferior quality; so in 1885, he made the first Lucas tape for his own use. His requirement as to quality of temper was not easily

Cut No. 6.

complied with, as you will see by cut No. 6. Brother engineers soon besieged him for tapes, for you can't hide a good thing long, and before he was fully aware of it, he was manufacturing for the trade. His watchwords were, *accuracy, quality* and *durability*. I met Mr. Lucas for the first time at the meeting of the Ohio Society of Civil Engineers and Surveyors, in January, 1894, at the Hollenden Hotel, this city. Many of our older members, no doubt, remember him very well. A mutual liking sprang up between us and I became his agent for Northern Ohio. I admired his ability, and soon recognized his sterling character, and our relations became more and more friendly and intimate year by year up to the time of his death in August, 1900. I felt his loss keenly. Upon the request of his son, and I believe at the express wish of Mr. Lucas before his death, the tape works were removed from Castile and became a part of our business in this city.

We have continued the high standard set by him and have made improvements wherever possible, and while the Lucas tape is intended for quick work in the field and especially for roughing it, it is not a cheap tape, and those of you who have been and are using it, know that what we claim for it is true. The bars upon which the tapes are graduated are checked at least once a year to conform to the Government standard at Washington, D. C. The tapes are supported throughout and are graduated under a strain of 10 pounds. The foot and link bars are corrected at 60 degrees F.; the meter and vara bars at 20 degrees C. We have sent to the Bureau of Standards for comparison in one shipment, seventy-five 100-meter and fifty 50-meter tapes, to be compared every twenty-

five meters, supported and suspended. The greatest variation found was only 0.0473 inch in 100 meters (328 feet), and it is nothing unusual for us to send a 500-foot tape for comparison at intervals of 100 feet, supported and suspended, and have it record zero over all. In 1909, we sent more than 33,000 feet of tape to the Bureau for comparison. The average variation did not exceed .01 inch in 100 feet. Before the end of the month, 14,000 feet now being made will be sent to the Bureau and from there to the Philippines, to be used on Government work; needless to say that they are all metrically graduated. There are now between 50,000 and 60,000 feet of Lucas tape in use there.

I hold in my hand two pieces of steel: One 15/64 inch and one ⅛ inch wide, from which the spiral pieces were made that are lying on the table. I am going to show you how easy it is to break them. . . . . Truly, I am surprised, for I deliberately kinked them, and naturally, expected them to break; but you see they have not done so. You can wind them around a chain pin and straighten them out again without breaking. Of course, you could not expect them to be straight after such abuse, for no tape is called upon to do such exhibition stunts in actual practice; although the kink, which it gets in practice, is far more dangerous. I will now coil them 2 inches in diameter and by letting go of them, you see that they straighten out again, which shows that the temper is just right. Neither of these tests alone is out of the ordinary, but both together are.

A party on one of the double-track railroads entering this city left a Lucas tape lying on the track opposite the one upon which a limited train was approaching. The suction gathered up the tape and when finally recovered, after a foot-race, it resembled a ball more than anything else. It took the party over two hours to straighten it out; and never a break.

In conclusion I will say that accurate measurements cannot be made with a tape unless temperature, strain and the relation of the tape to a horizontal position, are taken into consideration. You should know at what strain and temperature your tape is correct, both supported and suspended—especially the latter. Sixteen degrees F. (8.88 degrees C.) will cause a variation plus or minus of 0.01 foot in 100 feet, and 0.01 meter in 100 meters—assuming 62 degrees F., at which our tapes are graduated, to be the standard, as the Bureau of Standard refers all foot and link corrections to 62 degrees F., and the metric tapes to 20 degrees C. (68 degrees F.).

The coefficient of correction is given by the Bureau as 0.0000063 per degree F., and 0.0000114 per degree C.

I heartily agree with Mr. Varney that provision should be made for a public bar on which to test tapes, and will add that we will gladly test tapes on our bar at any time.

I think I can safely say it is and will continue to be the aim of leading manufacturers to supply tapes and instruments in which you can have confidence, swear by, instead of at.

Gentlemen, I thank you for your kind indulgence.

The Design of a Factory System

By A. B. Roberts.

Factory managers are rapidly becoming convinced that economical operation cannot be obtained without a proper system, though some heads of large concerns are afraid of what is conveniently called "Red Tape". In this connection, it should be stated that a multiplicity of printed forms and a segregation of accounts are not necessarily "Red Tape", but are requisites of cheap and accurate factory accounting. The printed form saves labor when again conceiving and writing a report, in so far as it obviates the necessity of again studying and analyzing the conditions, though not the results, which the form is intended to record, as well as saving a great deal of pen work. At the same time, printed forms can readily be filed according to some suitable plan so that the data so recorded may be accessible at all times.

Among the results, which can be accomplished by a proper factory system, are:

1. Accurate information as to unit cost of each type of product.
2. Cost of each operation for each type of product.
3. Prompt information as to the progress of work through the factory; whether all departments are well balanced, or whether some are congested and others have too little work.
4. Prompt information as to stock on hand, stock ordered, orders shipped or promised, and the percentage of promises kept.
5. Data is obtained so that all work can be laid out in advance and run through on a definite schedule, prepared by a Production Department.
6. The amount and distribution of all items of expense are shown.
7. Data is obtained, showing the total output by operations and the average per day or month.
8. Comparison is readily made to ascertain whether changed methods have resulted in a net saving.
9. The costs of work in process, finished work, and goods sold, are readily obtained, so that an accurate working balance can be made up each month to show the profit or loss for each department.

This last is very important, for any loss can readily be noted and the cause removed, or at least, conditions can be changed in the near future.

The charting of all data enables results to be compared more readily than if comparisons are made from a printed page, and enables the effect of business to be predetermined, pointing out what increased facilities the factory needs in order to handle the increased business in the most economical manner.

Many argue that it is a useless expense to obtain all the above items; but, it is evident that to compete successfully with other manufacturers, it is necessary to have detailed and accurate cost. Intuition based on former experience may be good, but definite knowledge based on facts is far more valuable. Also, intuition is often biased by the earlier training of the executive and influenced by the experience gained in the various departments in which he is or was especially interested. In concerns where data is not recorded, it is very difficult for a new man to take hold upon the death or resignation of those whose intuition has been the basis upon which prices were made. On the other hand, if the data is collected, but founded on incorrect principles, the conclusions are bound to be very misleading.

Before laying out a system, it is necessary to obtain data, showing the following:

1. The organization.
2. The plant layout and equipment.
3. The operations performed and their order of sequence.
4. The methods and forms in effect.

The new system should then be designed, as far as possible, to absorb the old methods in such manner that few radical changes are made necessary, as thereby better results probably can be obtained on account of the large factor of "Human Nature", or mental inertia, to be overcome when starting something different from the methods which have been followed for years.

Discussion of Items Entering into the Cost of the Finished Product.

Finished cost is made up of three main items:

1. Raw material.
2. Labor.
3. General, including selling, expense.

1. *Raw Material.*—The cost of raw material is, in most cases, an important item. Perpetual inventory records should be installed to give the following information:

Date ordered	Quantity	Freight charges	Unit List Price
Dealer	Discount	Quantity	Date issued
Purchase order No.	Net Price	and value of material on hand	Charged to

Maximum and Minimum Limits.—All material records should be handled by a competent stores clerk, who should give out material on requisition only, and should each month give to the Cost Department a summary showing:

Receipts.
Disbursements and distribution of same.
Inventory of stock on hand.

2. *Labor.*—It should be the aim of all employers to improve the efficiency of their employes. Aside from questions of factory design and equipment, efficiency can be improved by the use of the proper wage system.

Among the general systems of wage payment are the following:

Day work.
Piece work.
Differential.
Premium.
Bonus.

The question as to which plan to use can only be decided from a study of the conditions existing in the factory or department under investigation. Each system has its advantages and disadvantages. Where each job is so different from every other that it is almost impossible to predetermine the time required for completion, the most logical method of paying is by the day or hour rate. In this connection, it is suggested that much clerical labor is saved when the hourly rate omits fractions, thus, 10, 12, 14, 16, etc., up to 60 cents or over, doing away with the inconvenient practice of paying some such rate as 18¾ cents per hour, or $14.50 for a week of 55 hours.

When the work is more or less standardized, a great saving is effected by paying labor on a piece-work basis. In establishing rates to be paid, great care should be exercised in securing data as to the length of time required for each operation. Also, the so-called judgment of the different foremen will be almost useless in most cases, for very few foremen can know or remember the time required for the different operations on various sizes of product, though their estimates should be considered when checking the data obtained. If rates have been carefully calculated, there should be no excuse for changing them, unless improved machinery or methods are developed. Under this plan, the saving to the company results from the increased production for the same, or nearly same, overhead expense.

The Differential Rate Plan often results in a more equitable adjustment of wages to production. If it has been found that an average man can make 20 pieces of a certain kind in a ten-hour day and that for each piece 10 cents can be paid, it may be decided that in case he makes 21 pieces, the rate for each can be increased to 11 cents, or in case 22 are made in a day, the rate increased to 12 cents; but, if the production drops below 20 per day, the rate per piece remains 10 cents.

In order to give the employer as well as the employe a share in the direct profit, the Premium System has been devised. Under this system, the employe is paid by the hour or day, but obtains a premium for lowering the time cost per piece. This premium

is part of the saving and the employer receives the balance. The usual basis is to give the operator one-half the savings, or his hourly rate multiplied by one-fourth the time saved, in addition to his regular wage. For example:—Assume that the time limit is six hours for a certain job and that the operator's rate is 18 cents per hour. The following table shows the resultant hourly rate for various conditions:

TIME LIMIT	HOURLY RATE	HOURS WORKED	WAGES PAID		RESULTANT	
			STRAIGHT	TIME PREMIUM	TOTAL	HOURLY RATE
..	18	10	1.80	.....	1.80	18
..	..	9	1.62	.....	1.62	18
..	..	8	1.44	.....	1.44	18
..	..	7	1.26	.....	1.26	18
6	..	6	1.08	.....	1.08	18
..	..	5	.90	1/2×18= 9	.99	19.8
..	..	4	.72	2/2×18=18	.90	22.5
..	..	3	.54	3/2×18=27	.81	27
..	..	2	.36	4/2×18=36	.72	36
..	..	1	.18	5/2×18=45	.63	63

The Bonus System is practically the same as the Premium plan in that the hourly rate is increased in a certain ratio depending on the time saved. For example:—If ten pieces are finished in an hour, the rate per hour is 20 cents, and where there are 12 articles finished per hour, the rate becomes 22 cents.

It should be remembered when installing a Premium or Bonus System that where there is little machine work, the rate should be made low, since the rate of increase may be large, but where there is a large amount of machine work, more skill is required to increase production, and the Premium rate with a high premium can be used, and the tool made more productive.

The Premium and Bonus Systems do not cause so much loss to the management in case of over-estimation in the rate, as does the Piece rate, and provide a more equitable division of profits between employer and employe, though the clerical work necessitated is often materially greater.

3. Factory, General, and Selling Expense, and their distribution.

Among the methods of distributing expense are the following:

The Hour Rate.
The Percentage of Wage Basis.
The Direct Labor and Material Method.
The Machine Hour Plan.
The Modified Machine Hour Plan.
The "Production Center" Plan, using the Percentage of Wages Basis.

The Hour Rate—

In this method, all overhead charges, which include indirect labor, repairs, supplies, power, heating, lighting, taxes, insurance and depreciation, are distributed over the different jobs in proportion to the hours spent thereon by the workmen. This charge

per hour is found by dividing the total expense per month by the number of productive hours per month. It is claimed for this method that working conditions are correctly reflected and that the great value of the time factor is brought out. The simplicity of this system is its greatest advantage, but its disadvantage is that it makes no distinction between work on inexpensive machines, and work done on expensive machines, or on special machines working comparatively few hours per year.

The Percentage of Wages Basis—

This method is very widely used, but if it is used without modification, it may lead to erroneous conclusions. For example:—The workman, who is engaged at bench work, has the same percentage of the general expense charged to his wages as the operator of an expensive tool. This makes it impossible to compare the cost of different methods of production. The percentage to use in this plan is obtained by dividing the total expense by the productive labor wages per month instead of by the productive hours, as in the Hour Rate Plan.

The Direct Labor and Material Basis—

This plan is suitable to some conditions where the cost of material is fairly constant and where labor is on the Piece Work Basis; otherwise, the overhead percentage obtained will vary greatly from month to month.

The total expense per month is divided by the "prime", or material and labor cost for the same period to obtain the overhead percentage to use.

The Machine Hour Rate—

The Machine Hour Rate is one in which the total expenses are charged to a machine or process so as to show the total cost per hour for operating. This plan necessitates accurate data as to operating time and the percentage of idle time and is difficult to operate on that account.

The Modified Machine Hour Plan—

Under this system, the factory is divided into departments and each department sub-divided into "Production Centers," which are either machines or benches. Each "Production Center" is then considered as a unit and carries its own charges for insurance, taxes, maintenance, depreciation and power, irrespective of what the other Production Centers carry. All items which can be directly charged are divided by the operating hours per month to give a base rate per hour for each Production Center. To this is added a charge for items which cannot be directly charged, which may be distributed on either the Hour Rate or Production Wages Plan, and constitutes a supplementary rate, which is an indicator of the condition of the business, for as the production increases the supplementary rate decreases, and vice versa.

The Production Center Plan and Percentage of Wages—

Under this plan, the factory is divided into Production Centers, as in the case of the Modified Machine Hour Plan.

By the use of a Shop Order System, in which case each Production Center is given a Standing Order Number, all such items as Indirect Labor, Power, Water, Gas, Repairs, Supplies, Depreciation, Taxes and Insurance can be directly charged to each Shop Order Number, or Production Center. All general expenses can then be pro-rated to the Shop Orders, either in proportion to the productive hours or the productive wages for each Production Center. The total cost of each operation is thus determined each month and pro-rated over the jobs completed that month by each operation at a definite amount per unit of quantity, or per hour, or as a percentage of the productive wages per operation, giving a different rate for each operation the job has passed through. The total cost for each job is thus obtained up to the point where manufacture is completed, giving the Factory Cost.

The selling cost is then pro-rated over all jobs in proportion to their factory cost.

Under the shop order system, mentioned above, all time and material are charged to the departments and operations upon which it is desired to obtain a record of the cost of production. Each operation is represented by a single "Shop Order". Each "Shop Order" is divided by "letters" with divisions such as—

"A" meaning "Direct Labor".
"B" meaning "Indirect Labor".
"C" meaning "Supplies, etc."

This division into letters is for the purpose of charging the labor performed and material consumed in accordance with the various purposes for which it has been used in the department. All Direct Labor is to be charged to the "Work Order Number", covering the material being manufactured, as well as to the "Shop Order Number" representing the department in which the work is done.

All reports of labor and material used must show the proper Shop Order Number as well as the letter which indicates the purpose for which it has been used, according to the division shown on the department card.

The Department Shop Cards should be posted throughout the factory, placing in such department only the card which represents the operations conducted there.

The Shop Order Number System gives total costs each month per operation, and by having suitable production records, showing the quantities completed per month for each operation or Shop Order, the average cost per unit is readily obtained, while the scrap as a whole and per unit is shown each month for each operation.

In order to get Job Costs, or costs of individual items or sizes, all productive material and labor are charged to the Work Order Number as well as to the Shop Order Number. In the Work Order Number System, each size of product is given a number, which becomes a Standing Order Number for that size.

In order that costs may be entered in the book records each month it has been found convenient to prefix the number of the month before the number indicating the article, and close all orders each month. For example:—

STOCK SIZES	WORK ORDER NOS.	JAN.	FEB.	MAR.	APR.	MAY	ETC.
12 x 22 gauge.....	11	111	211	311	411	511	611
12 x 20 "	12	112	212	312	412	512	612
12 x 19 "	13	113	213	313	413	513	613

A summary can then be made each month, showing total cost of Work Orders, as follows:—

MONTH OF JAN., 1911

W. O.	MATERIAL (1)	PROD. LABOR (2)	FACTORY EXP. (3)	GENERAL AND SELLING EXP. (4)	TOTAL COST (5)
111	.....	.....	.....	.....	.....
112	.....	.....	.....	.....	.....
113	.....	.....	.....	.....	.....
ETC.					

The total of Column 1 for the total factory should check the distribution sheet, issued by the Raw Material stock-keeper. The total of Column 2 should check the Productive Labor as found from the Pay Roll Book. The total of Columns 2 and 3 should check with the total cost of the Shop Orders. The total of Column 4 should check with the total expense items, as shown by the General Books. The total of Column 5 shows the cost of operating per month, and can be compared with the Sales for the same period.

In calculating the operating expense, many accountants claim that an interest charge should be made, but this is incorrect for the following reasons:

A company is supposed to furnish enough capital to carry on the business, and if any borrowed capital is necessary, then interest on this capital is a charge against earnings and is not an item of cost. A company invests money for the purpose of receiving a return on the investment, and when computing the cost, it is not correct to charge interest at some arbitrary rate on investment. It also unnecessarily complicates ascertaining the actual profit, or return on the investment, when a certain percentage on a portion of the investment has already been charged to the cost.

The question then arises; if no interest charge is made, how should the item "Rent, or Equivalent", be handled? In reply to this it may be noted that the company which owns its own building and equipment has the advantage that it pays no rent, but it has increased depreciation, taxes and insurance charges, which tend to neutralize the apparent advantage, and at the same time there is a greater investment upon which to earn interest.

Charts and Diagrams.

The average bookkeeper is at a loss to understand data recorded by means of charts, and on this account few statistics are

kept in this manner. As a time-saver to the analyzer, and as a means of comparing data, the chart is unsurpassed. By its use facts are made evident that would probably never become apparent from a table of figures. Some of the charts, which are of especial value to the manager, are:

Chart showing the monthly receipts and disbursements, compared with those of a preceding period.

Chart showing the percentage each item of expense bears to the productive labor.

Chart showing the percentage each item of expense bears to the total cost.

Accumulative Record of Sales and Total Cost by months.—This is a valuable chart, and is a graphic representation of the income and expense sheet in that it shows the profit and loss for any period for the total factory and the different departments.

THE FOLLOWING DIAGRAMS REPRESENT GENERAL CONDITIONS AND ARE NOT DERIVED FROM ANY PARTICULAR BUSINESS.

Chart No. 1—Outline of Work Order and Shop Order System—

After a chart is made, showing the methods of collecting data that are in effect at the time investigation is started, a chart should be prepared, showing the revised methods in order to give a clear idea of the relation each record bears to the others and to the system as a whole.

The chart shown gives a typical analysis of a Shop Order and Work Order System as follows:

All material, which is manufactured with the intention of

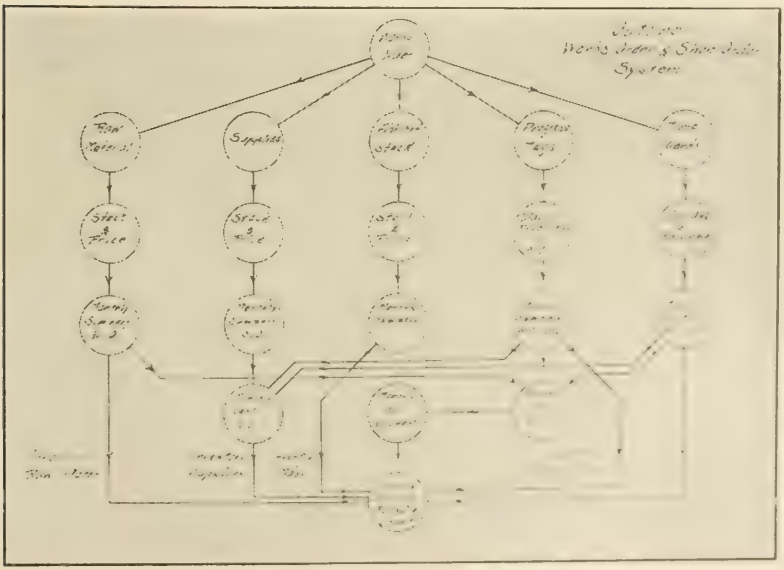


CHART NO. 1.

Chart No. 2-A.

being sold, is made up on some Work Order Number, as explained above. In order to fill any work order, raw material, supplies, or finished stock, may be drawn upon. Requisitions are necessary in order that accurate record may be kept of all material issued to the various departments. Progress tags are used to keep track of all work in process, and time cards are necessary for a correct distribution of labor costs.

Chart No. 2-B.

Chart No. 2—

The stores keeper or stock keeper should keep some such record as shown in Chart No. 2, so that a fairly accurate inventory may be taken at any time. From these perpetual inventory records summaries should be prepared periodically, preferably monthly, to show the distribution of all material issued.

From the progress tags daily production reports are prepared by the Production or Planning Department to show the stage of completion reached by every order in the factory.

The timekeeper should prepare summaries showing the pay roll distribution for each pay period.

All summaries should be sent to the Cost Department, where the data can be assembled to show the cost per shop order or

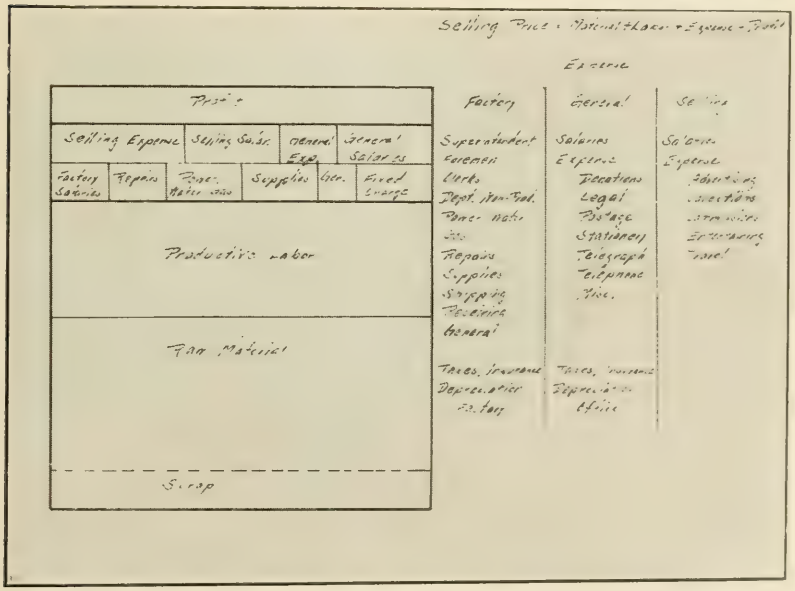


Chart No. 3.

work order, the value of material in process, and the cost of goods shipped.

The Cost Department can then make out a report to the Accounting Department, giving totals only, so that a working balance can be prepared to show the Gross and Net Earnings per month.

Chart No. 3—

From the data given above a chart can be prepared to show the percentage each item of cost bears to the total cost. This is often shown by plotting curves from month to month, but it has been found that many accountants can read a chart of the nature of Chart No. 3 more readily than one employing co-ordinates.

This chart shows which are the largest items of cost and

indicates where savings of 1 or 2 per cent will result in the greatest net saving. It will often happen that the addition of clerical help will affect savings in connection with scrap and other losses that will result in greatly increased profits.

Chart No. 4—

An accumulative record is valuable for ascertaining progress and predicting future business. In this chart the various lines are

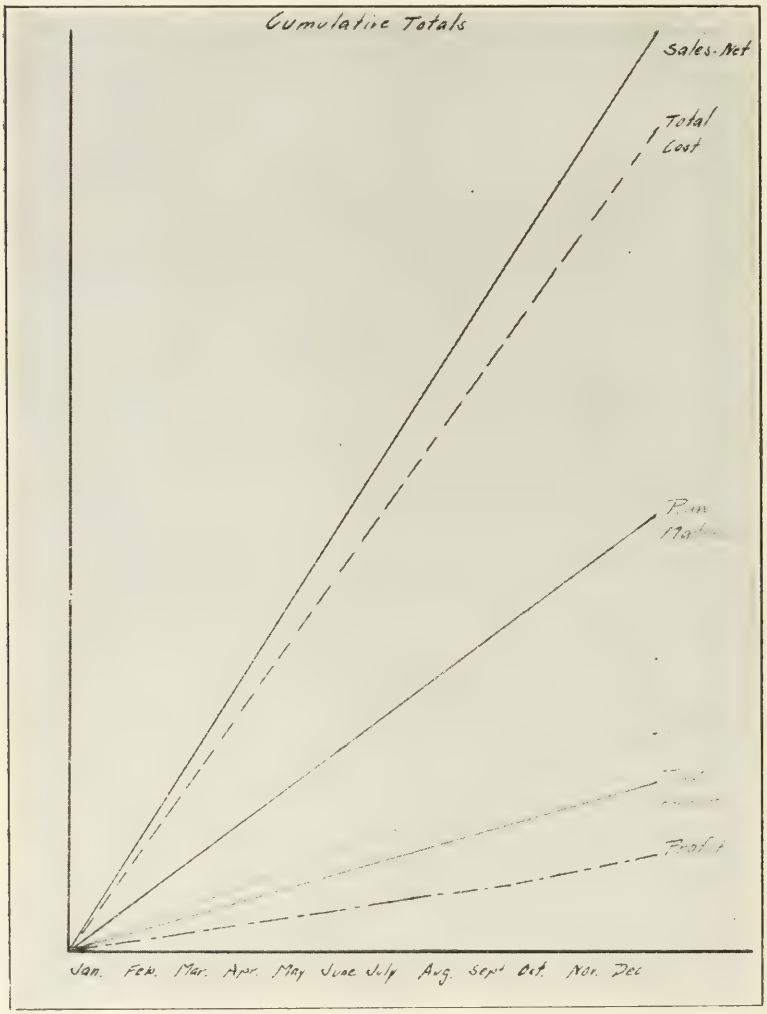


CHART NO. 4.

assumed as straight lines, though in practice this would probably not be the case.

Plotting the results of several years on the same chart, using different colored inks, one color for each year, materially assists in reading the chart.

Chart No. 5—

From this chart the influence of increased production upon cost per unit is readily shown.

The productions in pounds per month are platted as abscissae, the total costs of operating per month, including productive labor, raw material and expense, as ordinates.

In plants where piece-work prices are paid, the total cost per month for labor is directly proportional to the production This is true of the cost of raw material per month, provided the same unit prices are paid, though the chances are that with the increased quantities purchased lower unit prices will be obtained.

The overhead expense, however, starts with fixed charges at zero production and becomes more nearly parallel to the base

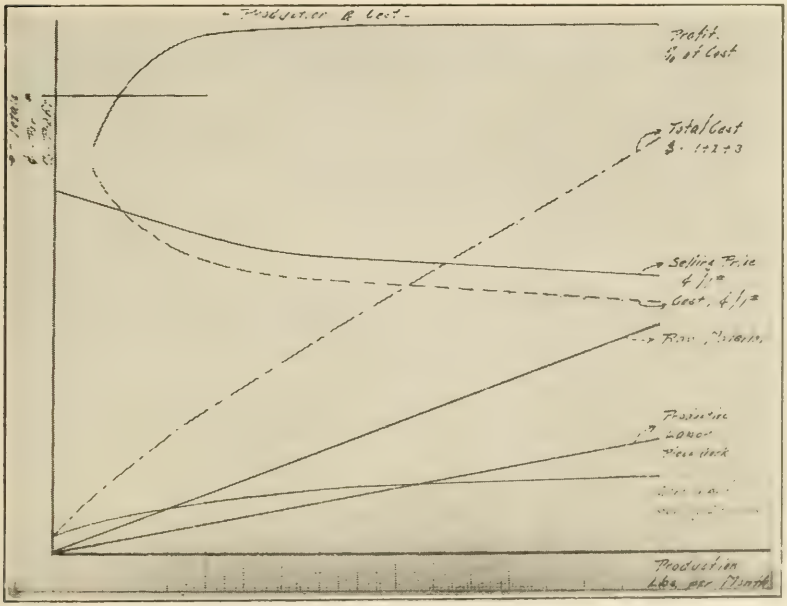


Chart No. 5.

line as production increases. The resultant total cost is then a curve, as shown by the dot-and-dash line.

The cost per pound is readily found by dividing the total cost by the corresponding pounds of production. This cost is shown by the broken line and starts with infinity at zero production and decreases more or less rapidly as production increases.

If the selling price has been fixed by competition, a certain rate of production must be reached before a profit can be made. However, after a profit commences, the selling price can be dropped as production increases and still make the same percentage of profit. Care should be taken when lowering the selling price to be sure that a point is not reached where the cost of

production will be equal to the selling price *when production drops off,* for the cost under decreasing production is higher than it was when production was increasing if the organization (overhead, selling, etc.) costs are not decreased to the former amount for equivalent production.

NOTE:—Chart No. 2, referred to in this article, refers to Charts No. 2-A and No. 2-B.

Discussion

By E. P. Roberts:

The value of records is undoubted. Any system of ascertaining cost necessarily has some arbitrary assumptions and to such extent is not exact and frequently it is a waste of time to carry out some items in detail, because the arbitrary assumptions may affect such item to a greater degree than a slight variation in one or more of the sub-items. In other words, the degree of accuracy desired should be predetermined and the degree to which the inaccuracy of the arbitrary assumptions may affect the result.

In the above connection, I again quote from an address of Dr. Howe, which was given many years ago, and which I have frequently quoted and which referred to the "fallacy of using eight place logarithms on four place data."

It is exceedingly important that the basis used be that most suitable to the business as a whole and to each sub-division under consideration.

Distributing all overhead charges based on labor only may be exceedingly misleading, and if the basis is wrong and the results on such basis are accepted as facts, it might be better if there were no records and the cost be guessed. In the latter case, there might be a chance of an approximately correct guess.

Unless results are analyzed, the expense of obtaining records is wasted. An analysis is most readily apprehended and digested if in diagrammatic form, and, therefore, diagrams are much more likely, than tables, to receive the attention of principals, who appreciate their value and convenience.

With reference to the rectangular diagram, the larger rectangle showing total cost and profit, and the smaller rectangles showing cost of various departments and the upper one profit, it seems to me that it is particularly suited to the bringing out of an important point which is frequently overlooked; that is, the *comparative* importance of various departments as affecting *total* cost. It also shows that quite a large increase in the clerical force is justifiable if it results in only a slight decrease in the percentage of cost in other departments.

Relative to piece system of payment, the author calls attention to the advisability of not changing the rate after it has been established. In my opinion, such action has been one of the principal reasonable arguments that labor organizations have had for objecting to the piece system, or any system of payment other than on the hour basis.

I consider the author's statement that interest should not be charged as part of manufacturing cost, correct fundamentally, but owing to the fact that it is frequently done, and some authorities advise it, I think that the point might be elaborated, and also that the place for considering interest be noted.

What is the object of any cash investment?

To obtain interest on the investment.

What amount of cash investment is required for a manufacturing business?

First.—Construction Cost, which is the cost of the plant *placed* in *operation.*

Second.—Working Capital, which is the amount required to conduct the business until such time as the cash returns from goods sold is sufficient to carry on the business, and this capital must be permanently maintained, and in addition thereto, there should be a reserve for contingencies, such as granting unusual credit or failure to collect. Among items requiring working capital are:

"A" Labor—usually entire amount of pay roll for considerable period.

Material—to a greater or less amount.

Factory—overhead charges, such as:

Superintendence.
Factory office expense.
Taxes and insurance.
Maintenance, including supplies and labor for same.
Power, light and heat, including supplies and labor for same.

"B" Selling Cost.

"C" Advance payments required, or advisable, such as insurance, advertising, etc., discounting bills payable, etc. The items under this heading will really be distributed under "A" or "B".

"D" To purchase patents, or other special privileges, which have a lessening value as time passes until at the expiration of a certain period the value is zero.

How may such capital be obtained if a corporation is formed?

First.—The stockholders paying in the entire amount, or:—

Second.—By bonding for part of the capital; the balance being obtained by subscription to common stock, or:—

Third.—By bonding and obtaining the balance by preferred and common stock.

The cash invested is the same in any case.

How can the financing plan affect cost of manufacturing?

If the manufacturing concern is a firm, or a corporation with stock only issued, and all expenses are paid, cannot it continue in business even if no interest on investment is earned? It can.

If, however, 6 per cent interest, or any other per cent, is charged as *part of the cost* and on such basis the cost is not earned by an amount equal to interest, which has been charged, has an actual loss been sustained? It has not.

Why not ascertain net profit above actual zero instead of above some higher point—arbitrarily taken.

If a Company requires $100,000 capital and can obtain it by selling $125,000 par value of stock at 80, or by selling $50,000 bonds at par and $100,000 stock at 50, does that affect *cost of manufacturing?* Not at all.

If the capital required is $150,000.00 cash and $100,000.00 is required for plant cost and $50,000.00 for working capital, and 6 per cent on $100,000 is charged as part of the manufacturing cost, should not 6 per cent on $50,000 be charged somewhere?

If so, to what shall it be charged?

If a portion of the $50,000 is required to carry customer's accounts and, owing to change in business conditions, instead of having to carry same as long as previously—cash on delivery is obtained, has the manufacturing cost been reduced? Not at all. The cash required in the business is less, and, therefore, if the investment be reduced, any amount available for dividends would be a larger percentage.

If the reverse conditions arise and more time has to be given and additional working capital thereby necessitated, has the manufacturing cost increased?

If there are two companies, one manufacturing and one selling, which one would benefit, or lose, by the conditions stated above?

Ex: If $150,000 is required—
$100,000 for plant,
$ 50,000 for working capital,
$50,000 obtained from bonds at par at 6 per cent = $3,000.00 interest; 6 per cent is charged on $100,000 (plant cost) as part of manufacturing cost.

If after paying interest on bonds there remains *according to the books* zero profit.

Is not the $6,000.00 charged to interest on plant in the treasury and available for dividend?

Have not the stockholders made 6 per cent on *their* equity, the $100,000 investment?

The manufacturing account would show no profit to the stockholders.

The amount of the investment, or the interest on investment, should receive consideration when comparing various possibilities, or actualities.

For example:—If two plants manufacture the same class of goods at the same cost, exclusive of cost of plant, and are of the same capacity, and one plant cost was $100,000 and the other $150,000 and only half the goods can be sold and it is decided to shut down one plant, decision will not be made on the basis of what the plant *did* cost, but for other reasons, such as transportation charges, labor, market, etc.

But if the question is which of such two plants *shall be* built, then the one which will cost the least is evidently the better investment if other factors are equal, as it is not a question of cost of manufacturing, but of investment required.

In other words, the question of investment and interest on same is a comparative one, actual or supposititious.

For example:—If the question arises, will it pay to purchase

an expensive tool to do certain work previously done by hand labor, the factors to be considered are:

First.—How much less will the labor charge be per unit passing test.

Second.—How will it affect cost of material per unit passing test. This and the foregoing include consideration of scrap and net cost of such scrap.

Third.—The maintenance and depreciation charge against the tool.

Fourth.—Cost of power required—additional or pro-rata, as the case may require.

Fifth.—Charges other than interest on additional space.

Sixth.—Cost of additional heating and lighting.

Seventh.—Additional cost, if any, of overhead charges of other nature, such as superintendent, factory clerical force, etc. But usually such overhead charges would not be a factor.

After ascertaining comparative cost per unit on such basis, and number of articles turned out per year, the net saving, if any, is shown, and such net saving is the net earnings on:—

Cost of the machine, plus power equipment, plus space required, plus any other construction charge.

The above principle applies to comparisons between departments, or complete plants.

A Company has two plants manufacturing similar articles and comparison is desired:—

First.—On manufacturing cost—ready to ship.

Second.—On cost at market.

Third.—On capital required to conduct each.

The transportation charges (second) affect net results to Company; but are they part of manufacturing cost?

If a Company is able to change from a long credit system to practically a cash basis, has it changed the cost of manufacturing?

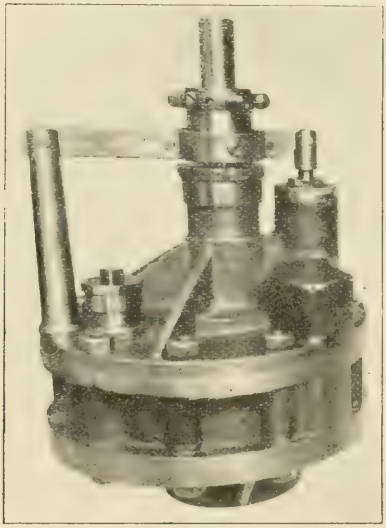
Such change would lessen investment required and the same net profits would give a greater rate of interest, but the *plant* investment would not be reduced.

A New Patent Hydraulic Clutch

By H. A. Brown.

The following is a description and illustration of a new hydraulic clutch, which, although not a new idea, still is the first thoroughly practical application of an old principle coming to our notice.

The clutch is very simple in its construction, consisting of *an outer case* keyed to a drive shaft eccentrically and being fitted with an oil-tight cover, and *a drum* keyed to the driven shaft con-

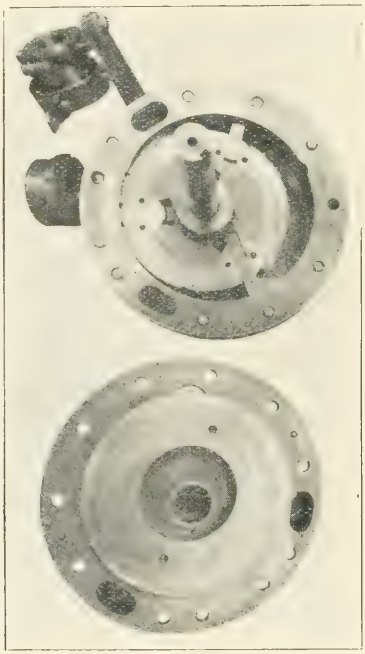


Exterior View of Clutch.

centrically so as to work snugly within this case, being mounted on two roller bearings in same, so forming a crescent-shaped cavity between the case and the drum. Two or more wings, otherwise called blades, working through slots in the periphery of the drum swing about a pin centered on the case. Thus an eccentric motion is imparted to the blades which is taken care of by rocker bearings set in the drum. Cast in the case is a valve of the plunger type, operated in the usual way by a sliding sleeve, controlling a passage which has its entrance and exit at the end of the crescent-shaped cavity mentioned. There is a take-up plate screwed into the cover, which is a sliding fit in the case and is operated externally by means of a rack cut on the plate and a

pinion cut on the pin, having its bearing in the cover. All moving parts are accurately machined to a sliding fit, and as the entire mechanism is working in oil, friction is reduced almost to zero.

The action when the valve is thrown open, allowing the oil to flow freely, is similar to a rotary pump, except that the oil never leaves the case, but flows continually in a circular path. To set the clutch, simply close the valve, thus stopping the flow of oil and bringing the speed of the drum up to that of the case. This clutch does not compound power, but is a variable speed clutch when so desired, and, as a positive coupling, is far superior to any friction clutch.



View of Clutch with Cover Removed.

This last statement may appear to be too comprehensive, but it must be considered that the vast majority of clutches now in use are dependent on friction in some form, and therefore the working parts are continually wearing, necessitating frequent repairs and expensive delays. This hydraulic clutch, however, does not transmit power through friction, and in fact has no friction of consequence at any time, and none at all when the clutch is thrown in, as the entire mechanism is immersed in oil at all times.

Another point in its favor is the smooth, easy manner in which it picks up the load, the valve being graduated to govern the flow of oil to a nicety. This is especially interesting to the automobile industry, as it eliminates the necessity of shifting

gears when a reduction of speed without an increase of power is desired.

Regarding the cost of this clutch, as compared with others now in use, it can be said that it is much less expensive; for, the cost of maintenance is reduced to a minimum, owing to its frictionless qualities and consequent long life. The initial cost of a hydraulic clutch of small capacity would be about the same as any other, while the cost of the larger ones would be considerably less in comparison, due to the fact that they do not depend on friction to transmit power, and are limited only by the maximum pressure at which oil can be retained in the case.

In a very recent shop and road test, conducted by a large local automobile company, a three-blade, 7-inch diameter clutch was used on a 30-horsepower engine, having a free running speed of 1,000 revolutions per minute. A heavy cylinder oil was used under a normal pressure of about 1,000 pounds per square inch. This was not a new clutch, having seen hard service in a five-passenger, 30-horsepower car for over seven months in the city of San Francisco, and yet it slipped the rear wheels on low gear and stalled the engine on high in the shop test, fulfilling all the conditions of a road test better than any cone or multiple disc clutch. This was done with no apparent slippage while positive, nor was excessive heat noticeable when testing its variable speed feature.

During the above test I was present and nothing detrimental was observed except a slight drag when the clutch was thrown out, and as this clutch, being the first one built, is somewhat crude in its construction, it is believed that most of this drag can be eliminated. There is apparently no reason why this clutch could not be adapted to line shaft, hoisting and conveying machinery of all kinds, power boats and in all places where clutches are used.

Report of Special Commission on Collapse of Henke Building

"Nov. 23, 1910.

"Mr. J. W. Frazier, *President*,
The Cleveland Engineering Society, Cleveland, O.

"My dear Mr. Frazier:—It is my earnest desire that a thorough, complete and impartial investigation be made of the causes leading to the collapse of the H. A. Henke Furniture Co.'s building, at Lorain avenue and West Thirtieth street, last night. With that end in view, I request the co-operation of the organization of which you are the president. For this purpose I am anxious that you name two representatives of your organization to act with an equal number from the Builders' Exchange and the Cleveland Chapter, American Institute of Architects. That there may be no delay in beginning this investigation, I have requested the presidents of these other organizations to have their representatives present in my office at two o'clock this afternoon, so that plans may immediately be made for the beginning of the inquiry.

"It is the purpose of this department to fix the blame where it belongs. I feel that the men making the investigation should be men familiar with the details of construction and the preparation of plans. It is because of this that I have asked that representatives be named from these three organizations. I sincerely trust that you will co-operate with this department in bringing about this investigation. Very truly yours,

(Signed) F. G. Hogen, *Director of Public Safety.*"

(Similar letters were sent to C. E. Towsley, President of the Cleveland Chapter, American Institute of Architects, and E. E. Teare, President of the Cleveland Builders' Exchange.)

The commission was organized by electing Herbert B. Briggs chairman, and W. O. Henderer secretary, and proceeded with the investigation in accordance with the above letter, and the report follows:

The commission based its report on information gathered in nine (9) visits to the ruins, on testimony taken at seventeen (17) public sessions, at which eighty-six (86) witnesses were examined; at five (5) sessions before the coroner, where twenty-two (22) witnesses were examined, on the results of explorations of the ruins made at the expense of the City, and in twenty-eight (28) private sessions.

Description of Building.

The building, which replaced a building destroyed by fire May 12, 1910, extended along Lorain avenue 103 feet, along West Thirtieth street 90 feet, and contained a basement and four stories. The original drawings called for a wall-bearing building of mill construction, but alternative tenders were received for reinforced concrete construction, and the contract was awarded for the latter, the type adopted being a wall-bearing structure with the conventional reinforced concrete column, girder, rib and tile floor, with slab cast monolithic with girder.

Portions of the basement walls, the smoke stack, the west wall to level of the third floor and the show window lintel girders of the burned building were retained in the new construction. The new footings of walls and columns were of plain concrete.

View from Lorain Ave., Showing Wreck of Henke and Adjoining Building.

The Lorain avenue and West Thirtieth street fronts of the building were faced with sandstone and shale brick. The inside of exterior walls was faced with new hollow brick and all other parts up to the fourth floor were built of brick taken from the burned building. The fourth story and parapet walls were built of new brick.

The building was to be used as a furniture store and was owned by H. A. Henke. The architects were Searles, Hirsch & Gavin, and the contractor was The Forest City Construction Co.

Construction Data.

The contract was signed July 25, 1910; included all trades except plumbing, heating and electrical work; provided for the

completion by Nov. 10, 1910, and contained a bonus and damage clause of $10.00 per day for completion before or after the latter date. Work was commenced July 28, 1910, and the building permit issued Aug. 11, 1910. The rate and progress of construction and weather conditions are shown on the accompanying tabulated statement, marked Exhibit B.

Collapse of Building.

From the evidence submitted, it appears that the collapse occurred at about 7:15 P. M., Tuesday, Nov. 22, 1910, and that the time elapsing between the initial failure and the wrecking of the building did not exceed one minute. The collapse was complete and practically instantaneous.

While no fatalities occurred in the Henke building, the upper portion of the west wall fell on and crushed the adjoining building, occupied as a store and living apartment, resulting in loss of life and injury to the occupants.

The accompanying photographs clearly show the conditions of the ruins at the time your commission visited them on Nov. 23 and 24, 1910. (See Foot Note.)

It is the belief of your commission that the initial failure was due to the premature removal of forms and supports in the third story, as from the testimony of eye witnesses and other evidence, the initial failure presumably occurred (1) in the east section of the fourth floor, or (2) in one or more of the third story columns, or (3) a combination of both.

The weather reports show very unfavorable conditions during the construction of the third and fourth story columns and the fourth floor and roof slabs, and in view of the short time the third story columns and fourth floor had been in place, the concrete had not developed sufficient strength to carry the roof and roof forms as a dead load when these third story forms and supports were removed.

Primary Causes of Collapse.

In fixing the cause of and the responsibility for the collapse of the Henke building, your commission believes it well to name the parties engaged in the design and construction of the building, and to consider the relation and responsibility of each party to the collapse. The parties are: The architects, the contractor, the owner, and the Department of Buildings of the City of Cleveland.

In considering each party, it is well to remember that the negligence of any one may be a contributory cause to the collapse. The following data covers, in the opinion of your commission, the primary causes of the collapse.

Architects.—It is the belief of your commission that the architects were negligent in the following respects:

1st. Although the evidence shows that the architects advised and requested the owner to place a special reinforced concrete inspector on the work during the progress of the construction, they did not specifically call the owner's attention to Section 473

of the Building Code, which by mandatory requirement provides that the owner shall place such an inspector on the work.

2nd. The architects did not name in the application for the building permit a special inspector—as required by Section 473—who was to be continually on the work during the placing of concrete and steel. Assuming the architects to be experts in building construction and acquainted with the provisions of the Building Code, they should have caused the owner to name an acceptable special inspector and co-operated with the Department of Buildings in the enforcement of this section.

3rd. The architects did not give adequate consideration to the removal of the forms for the concrete work. They evidently gave little attention to weather conditions from Oct. 22 to Nov. 22, inclusive, when, according to the United States Weather Reports, there were sixteen (16) days in which the temperature was

Wrecked Henke Building, from Lorain Ave.

at or below 35 degrees—on nine (9) of which the temperature was 32 degrees or below—with a minimum of 25 degrees; and during which time there were only four (4) clear days with fifteen (15) days of rain or snow. Under these weather conditions more than ordinary precautions should have been taken in the removal of forms.

4th. The architects did not give adequate consideration to the sand used in the building. The specifications called for washed sand, while unwashed sand, not of uniform quality, was used.

5th. The architects did not exercise proper judgment in advising the owner in regard to the rapidity with which the work could be safely prosecuted. The testimony shows that the work was hurried from the beginning.

In view of the foregoing points of neglected duty, it is the

opinion of your commission that the architectural supervision was deficient.

CONTRACTOR.—It is the opinion of your commission that the contractor upon signing the contract assumed the responsibility of executing the work in accordance with the plans and specifications, and any deviation from them should have been made only upon order of the architects; but that the contractor should not be held responsible for errors of design.

It is the belief of your commission, based upon the evidence submitted and investigation of ruins, that the contractor was negligent in the following particulars:

1st. The foremen employed on the building were ignorant of the requirements of the drawings and specifications; were ignorant of the proper methods of handling concrete for reinforced concrete work; did not know what kind of cement was being used; did not exercise proper care in the measurement and mixing of concrete aggregate and the placing of reinforcing steel; allowed brick work erection of forms to proceed upon green concrete; and conducted the work generally in a loose, slipshod and hurried manner.

2nd. The reinforcing steel was carelessly placed in ribs, girders and columns, and no provision was made to insure steel being in its proper position after concrete had been poured. The girder rods did not extend the proper distance beyond the column centers; girder shear rods and column hoops were improperly or insecurely placed; sleeves used for splicing column rods were of improper sizes, carelessly placed and not filled with mortar.

3rd. The structural members of concrete were not of proper sizes, concrete was of poor quality and not properly placed, as shown by the following particulars:

(a) Whereas four (4″) inch slab ribs were called for, many three (3″) inch ribs were found.

(b) Several girders and slab ribs were found to be badly honeycombed.

(c) Broken specimens of concrete showed it was not of uniform quality.

(d) Due to work being done on green concrete, the bond between concrete and steel was broken.

(e) Header tile were not filled as specified, causing loss of mortar in the concrete of adjacent girders.

(f) In some cases, sawdust was found in bases of columns.

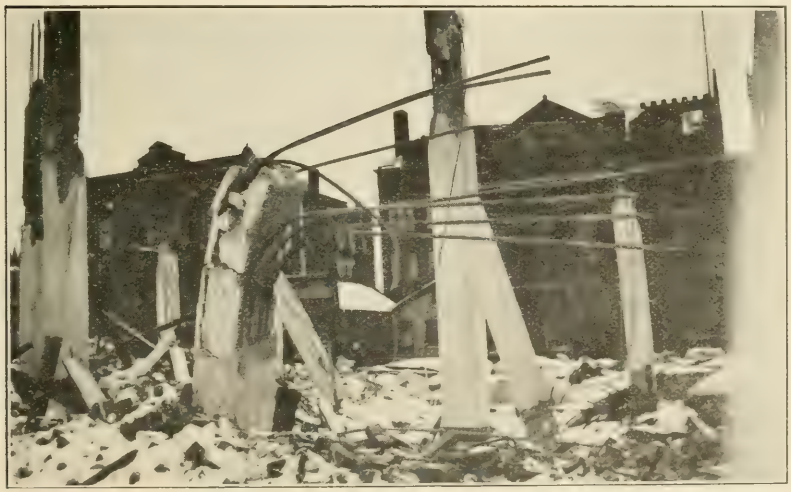
4th. The sand used was, in many cases, of inferior quality, contained loam and clay and did not meet the specification requirements for washed sand.

5th. The cement delivered at the building was apparently twenty (20%) per cent less in amount than the amount necessary to properly construct the work in accordance with the specifications. See Exhibit D.

6th. The forms were usually removed without the consent of the architects in violation of the specification requirements.

In the east side of the third story, forms, supporting the fourth floor, were removed in sixteen (16) days after the pouring of concrete, and the floor re-shored. The removal of these forms, in this short time, was, considering the weather conditions during the month of November (See Exhibit B), extremely dangerous. This time would hardly have been sufficient under favorable weather conditions.

These forms were removed without the consent of and contrary to the instructions of the architects. Although braces ordinarily used in re-shoring might have been sufficient under ordinary conditions, under the above noted conditions, the original forms and shores should have been left intact a much longer time; as, by removing the same, the slightest settlement in the floor would have tended to break the bond between the steel and concrete, thereby destroying the efficiency of the reinforced concrete.



Detail Showing Damage to Columns.

It is the opinion of your commission that the removal or changing of these forms and shores was the one primary cause of the collapse.

Owner.—In the opinion of your commission, the owner was negligent in that he did not employ a special reinforced concrete inspector on the building as advised by the architects.

Department of Buildings.

Section 473 of the Building Code provides in part as follows:

"When any concrete wall or armored, reinforced trussed concrete is used in construction, the owner shall provide for the inspection of cement and inerts, as required by the Inspector of Buildings; he shall also provide a special inspector of the work who shall be satisfactory at all times to the Inspector of Buildings, and

who shall be on the work continually during the mixing and the placing of concrete and steel. Such special inspector shall make daily reports to the Inspector of Buildings on the progress of the work.

"Before isssuing a permit for the work, the owner shall name in writing, the special inspector, and such special inspector shall pass such examination as may be required by the Inspector of Buildings to determine his competency."

It is the opinion of your commission that this provision of the Code was not complied with in any particular. This section is mandatory and in view of the extreme importance of close, careful supervision and inspection of this class of construction, and in view of the fact that the cost of such service is at the expense of the owner, we do not believe the evidence shows any excuse whatever for the non-enforcement of this requirement and we believe the Inspector of Buildings was negligent in that he did not insist on the owner having a competent special reinforced concrete inspector on the building.

The evidence shows that the Inspector of Buildings, Engineer of Construction and the Masonry Inspector in that district were at the building enough times to have ascertained whether such special inspector was on the work or not; to say nothing of the fact that daily reports were not being made to the Inspector of Buildings by such special inspector.

In view of the evidence submitted and data obtained, your commission is of the opinion that the enforcement of Section 473 of the Building Code is not only practicable, but that it would be of assistance to the Inspector of Buildings in the supervision of reinforced concrete work, especially as this assistance and service would be without expense to the City.

Contributory Causes.

In addition to the foregoing, the investigations of your commission show carelessness in the design and construction of the building in a number of instances, which undoubtedly contributed to the complete and instantaneous collapse of it, as indicated, in part, by the following: Effect of thrust of fourth story arches; use of excessive number of brick bats or half brick; use of thick mortar joints and soft brick; eccentric loading of piers supporting show window lintels; and inadequate support for south end of West Thirtieth street show window lintel—evidence shows that this support was changed during construction from a steel channel column to a brick pier.

Much of the brick mortar was poor; some of the lime was not thoroughly slaked; some of the mortar was mixed and built into walls while hot from the slaking of lime, thereby destroying the value of the cement; and unwashed sand containing loam and clay was used.

Explosion Theory.

After a thorough investigation, your commission is of the opinion that the disaster was not caused by an explosion.

Settlement of Column Footings.

The testimony shows that sand has been taken from near column footings, but it is the opinion of your commission, based upon its investigation, that the collapse was not caused by the shifting or settlement of the column footings.

Reinforced Concrete Design.

From the evidence submitted your commission is satisfied that the reinforced concrete design was a safe one.

Comment.

Construction Changes.—Section 219 of the Building Code provides in part that—"If during the progress of the execution of such work (referring to construction after building permit is issued) it is desired to deviate in any manner affecting the construction or other essential of the building, from the terms of the application (for the building permit), plans or specifications, notice of such intention to alter, or deviate, shall be given in writing to the Inspector of Buildings and his written assent be obtained before such alterations or deviation may be made. If such change or deviation affects the bearing or structural parts of such building, or its classification or grade of occupancy, new plans thereof shall be submitted to the Inspector of Buildings for approval."

The testimony shows that several changes were made in the construction as the building progressed, which were not reported to the Department of Buildings either by the architects or the inspectors from the Department.

In the opinion of your commission, some of these changes improved the construction and others weakened it. Your commission believes, in all matters affecting the structural features of a building, architects and department inspectors should implicitly comply with the provisions of Section 219 of the Code.

Concrete Construction.

Your commission finds, from its investigation, no reason to condemn the use of concrete in combination with steel for the structural parts of buildings, provided: The concrete is composed of proper materials, accurately measured and thoroughly mixed; the steel of sufficient strength and properly placed; the work installed by competent contractors and workmen; and the specifications, drawings and construction prepared and executed under the direction of competent designers and inspectors.

The Investigation.

Your commission was assisted in its labors by the fullest co-operation of the architects, contractor, owner and Inspector of Buildings. Testimony, with very few exceptions, was freely given.

Through the courtesy of the City Solicitor and the Coroner, your commission secured verbatim transcripts of the testimony of all witnesses examined.

Your commission has endeavored to so conduct its investigation that all personal considerations would be eliminated, that facts

be found and stated, and that lessons be drawn to provide against the recurrence of similar disasters.

The attached schedule lists the supplemental data in the form of exhibits which accompany this report.

Your commission begs to express its appreciation for your co-operation and submits this report as covering the causes of the collapse of the Henke building.

Respectfully submitted,

(Signed) HERBERT B. BRIGGS W. O. HENDERER
VICTOR E. THEBAUD JAMES R. GLOYD
B. R. LEFFLER J. C. SKEEL

SCHEDULE OF DATA ACCOMPANYING REPORT ON HENKE BUILDING COLLAPSE.

JANUARY 11, 1911.

Exhibit A—Recommendations.

Exhibit B—Construction Time and Weather Data—May 17, 1910, to Nov. 22, 1910.

Exhibit C—Photographs of Ruins, taken Nov. 23 and 24, 1910.

Exhibit D—Cement, Sand and Brick Quantities.

Exhibit E—Copy of Building Permit Application and Building Inspector's Report.

Exhibit F—Copy of Extract from Specifications.

Exhibit G—Copies of Contracts between Searles, Hirsch & Gavin and H. A. Henke; and The Forest City Construction Co. and H. A. Henke.

EXHIBIT A.

DATA ACCOMPANYING REPORT ON HENKE BUILDING COLLAPSE.

MR. F. G. HOGEN,
Director of Public Safety,
City of Cleveland.

Dear Sir:—The Commission appointed by you to investigate the collapse of the Henke building begs to supplement its report by the following information and recommendations based upon its investigations.

The Building Code was criticised by the Inspector of Buildings in three principal particulars: (1) the multitudinous duties imposed on the Inspector; (2) the lack of sequence in the Code resulting from its many reference features; and (3) the insufficient force authorized by the Code for its administration.

The administration of the Building Code is wholly upon a mandatory basis, a provision which in general is wise and proper, but one which, in some cases, imposes unnecessary hardships upon owners and builders. The Code should be so changed that, in cases where unreasonable requirements prevent the construction of safe and proper buildings and structures, a provision should be made which will permit such buildings and structures to be erected.

Your commission addressed a letter to over one hundred architects, engineers, contractors, owners and others interested in building operations, asking for replies upon the questions raised by the Inspector of Buildings relative to the Code, upon the Code's mandatory features and upon the advisability of licensing architects, engineers and contractors.

The replies to this letter and the investigation of your commission show an intense interest in the questions raised and indicate that imme-

diate steps should be taken by the city to enact such legislative measures as may be necessary to adequately meet the apparent defects in the Building Code.

Your commission, therefore, begs to submit the following recommendations, respectfully asking that you give them careful consideration and, if they meet your approval, that they be referred to the City Council:

First. That a Commission of building experts, not connected with the Department of Buildings, be created and authorized to prepare a thorough and complete codification of the Building Code.

That this Commission be requested to investigate and report to the proper department or body of the city government upon the following matters:

(*a*) The field and function of the Department of Buildings.

(*b*) The working relationship between the Department of Buildings, the Department of Police, the Department of Fire and the Board of Health, to ascertain whether these departments are working in co-operation; and to find whether there is any unnecessary overlapping of duties in these departments.

(*c*) The force employed in the Department of Buildings, to ascertain whether the present force is sufficient to administer the Code.

(*d*) The administrative and business methods of the Department of Buildings.

(*e*) Title X of the Building Code, to ascertain whether it fully and adequately provides for concrete construction.

(*f*) The duties of the Inspector of Buildings, to ascertain whether it is practicable for him to effectively discharge these duties.

(*g*) The consideration of the qualifications for architects, engineers and contractors engaged in the erection of buildings and structures in the City of Cleveland.

(*h*) The consideration of the question as to effective enforcement of Section 241 of the Building Code, which provides a penalty for violation.

(*i*) The consideration of any and all other matters resulting from the codification work, which will improve and make the Building Code more efficient.

Second. That a permanent Commission of building experts be created and authorized to serve in an advisory capacity to the Department of Buildings and the Board of Appeal in the determination of technical questions, arising from the administration of the Code; in the consideration of new forms of construction or of materials used in the same; and in all technical and administrative matters upon which the Department or Board may ask or require advice.

Respectfully submitted,

Herbert B. Briggs	W. O. Henderer
Victor E. Thebaud	James R. Gloyd
B. R. Leffler	J. C. Skeel

Foot Note:—The illustrations here shown are not from photographs which accompanied the report, but were taken a few days after the collapse.

Obituaries

ALBERT H. PORTER, C. E., A. M.

A MEMOIR.

Albert Hezekiah Porter was born September 20, 1843, and died at Thetford Center, Vt., December 10, 1909. He was graduated from Thayer Scientific School, Dartmouth College, in 1873; Professor of Mathematics and Civil Engineering, Iowa State Agricultural College, Ames, Ia., 1874-5; in the Engineering Department, King Iron Bridge & Mfg. Co., and Engineer for Curtis, Morris & Diver, Western Agents for the Morse Bridge Co., 1877 to 1884; Engineer for the Indianapolis Bridge Co., 1885; and from 1886 to the time of his retirement on account of failing health, was Computing and Designing Engineer for the King Iron Bridge & Mfg. Co. (now King Bridge Co.) in Cleveland. He became a member of The Civil Engineers' Club, of Cleveland, April 3, 1880; was Corresponding Secretary, March 12, 1889, to March 11, 1890; Secretary, June 10, 1890, to March 15, 1892; Vice President, March 15, 1892, to March 14, 1893; President, March 14, 1893, to March 13, 1894; and was placed on the retired list of members, April 5, 1904, at the time he gave up active work in the profession.

Mr. Porter was a conscientious, zealous member of this Society during the entire time of his active connection with it, and its success during that period was largely due to his unflagging efforts for its prosperity and advancement.

Professionally, he was an earnest, painstaking, methodical worker, and it was his constant aim to do well the tasks that fell to his lot.

The members of this Society, who knew him, felt a keen sense of regret at the illness that caused his removal from amongst us, and which finally terminated in his death, and as a Society, we wish to record here our appreciation of his earnest efforts for its success, and our regret that he can no longer be with us.

MICHAEL BAACKES.

A MEMOIR.

Michael Baackes was born in 1849, in St. Toenis, Germany, and died at Dusseldorf, Germany, October 18, 1910, of apoplexy. In early life, he was engaged in the manufacture of silk, in Crefeld, Germany, having been superintendent for Peill & Aurels and for Klemme & Co., manufacturers of silk velvets. In December, 1874, he came to the United States, and in 1875, started the first factory for the manufacture of wire nails in this country, the American Wire & Screw Nail Co., at Covington, Ky., thus earning the distinction of being the "Father of the Wire Nail Industry." The first nail machine installed in this plant is now in the Museum of the American Steel & Wire Co., at Worcester, Mass., and stands under a portrait of Mr. Baackes. In 1878, he made the first steel nails from Bessemer steel, furnished by the Cleveland Rolling Mill Co. In 1879, he came to Cleveland, and with members of the Chisholm family, organized the H. P. Nail Co., becoming its General Manager. In 1889, he organized the Baackes Wire Nail Co., and built for it, after his own designs, a model plant, comprising rod, wire, nail and fence mills. This plant was later known as the Consolidated Mill, and eventually became part of the American Steel & Wire Co.

From 1898 to 1903, Mr. Baackes devoted himself entirely to consulting engineering work in connection with building and remodeling plants for the manufacture of rods, wire and nails. In 1903, he became a special representative of the United States Steel Corporation in Europe, which position he held at the time of his death.

He became an active member of The Civil Engineers' Club, of Cleveland, March 9, 1886, and was placed on the retired list, April 5, 1904, subsequent to his departure for Germany. His interest in the work of the Society has been evidenced by many donations to its library, the last having been made only about a year before his death.

He is survived by his widow, a brother, Mr. Frank Baackes, Vice President of the American Steel & Wire Co., several sisters and three nephews, Messrs. Max, Carl and Ernst Boley, the last named being Assistant General Superintendent of the American Steel & Wire Co., in Cleveland, and to these the Society extends sincere condolences.

BRIGADIER GENERAL JARED A. SMITH.

HONORARY MEMBER.

A MEMOIR.

Jared A. Smith was born at Wilton, Maine, July 6, 1840. He died in Cleveland, December 17, 1910.

General Smith's early education was obtained at New Sharon, Maine. He was appointed to the United States Military Academy at West Point in 1858, and was graduated June 17, 1862, receiving the commission of Second Lieutenant of Engineers, and was assigned to the Second Army Corps on the staff of General Banks. He was wounded during a skirmish near Culpepper Courthouse, in August, 1862. Upon recovering from this wound, which rendered him unfit for service at the front, he was made an Assistant Pro-

fessor at West Point. In August, 1863, he was appointed an Assistant Engineer of Construction of Defenses for the northern coast. Was in charge of the construction of defenses for Baltimore and Washington in 1864, when they were threatened by the enemy.

From the close of the Civil War until his retirement from the army, General Smith was engaged in designing, and in the construction of coast defenses, river and harbor improvements, also as lighthouse engineer in various parts of the country. He was in charge of the river and harbor improvements in the Cleveland district from 1891 to 1900, and during his administration, many important improvements were made. He designed and introduced

an improved construction of breakwaters and piers, both in timber and concrete. He was also Lighthouse Engineer for this district from 1891 to 1897, designing and constructing the range lights at Lime Kiln Crossing and Maumee Bay. He also devised an improved type of lantern for lighthouse service, and sound deflectors for fog horns.

He was made Division Engineer of the Pacific Division, December, 1901. From 1902 to 1903 was in charge of improvements and defenses for the Delaware River and Delaware Bay, and streams tributary to same.

He was retired from the army with the rank of Brigadier General, in April, 1903. After retiring from service in the army, General Smith was located in Cleveland, where he was actively engaged as a Consulting Civil Engineer. He was a member of the Cuyahoga Building Committee from 1905 until his death, being its President for the past two years.

General Smith was President of this Society during 1899-1900, and was elected an honorary member in 1902. In addition to his numerous military and engineering connections, he found time for considerable study of mythological literature and of research on the subject of the intellectual development of the human race.

As an engineer, whose life was almost entirely spent upon public work, General Smith always was a vigorous exponent of what he believed to be the public's interest.

As a citizen, it is difficult to recount General Smith's achievements from those as an engineer. While he served on many special commissions, both military and civic, with distinguished credit to himself and to the public, it was his infectious enthusiasm and dominant buoyancy that greatly augmented his professional efforts. His friends will ever remember General Smith by his constancy, his sunny nature, his great appreciation of humor, but above all by his high esteem of honor and integrity.

We, the Cleveland Engineering Society, hereby express our appreciation of the great loss by the death of this eminent engineer and useful citizen; and as friends and associates of General Smith, we record this Memorial in recognition of our sense of loss, and of our sincere sympathy to the members of his family.

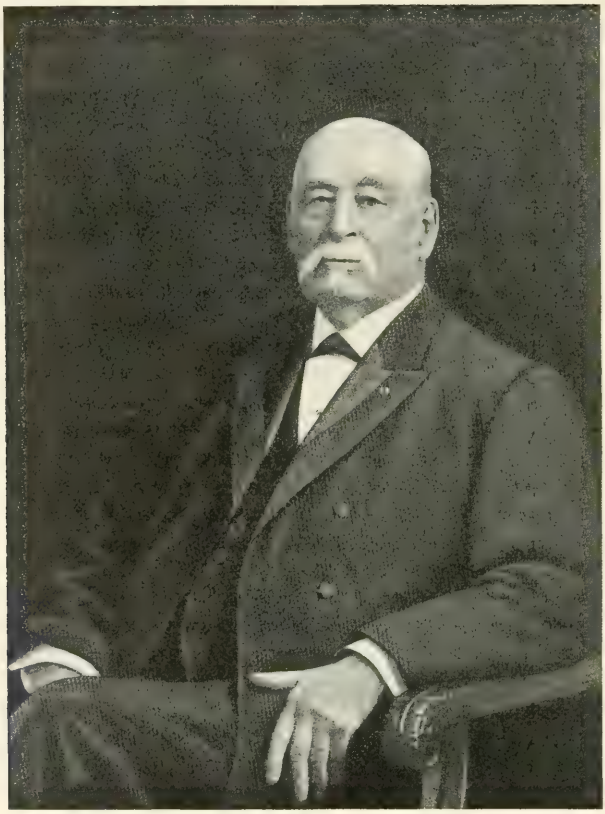
GENERAL JAMES BARNETT.

Honorary Member.

A MEMOIR.

The broad interests of him who has been long and justly known as Cleveland's foremost citizen, General James Barnett, extended to constant membership in this society since its inception, in 1881, though its activities related little to his own, and though he was rarely able to attend its meetings.

During his long and useful life, the connection which he thus carefully maintained with it was always recognized by the Society as a signal honor. In his death, it becomes a cherished memory,



befitting the record of a brave and valiant soldier, a singularly upright man of affairs, a citizen trusted and esteemed beyond all others in the community.

His was a character above all praise, a personality that conferred distinction upon every organization with which he was connected and leaves each one poorer for his loss.

In token of our sense of that loss, the Committee recommends that this brief memorial be spread upon the minutes of this meeting and a copy sent to Mr. Alexander E. Brown, representing the family of General Barnett.

JOHN W. SEAVER.

RESOLUTION.

RESOLVED: That in the sudden and untimely death of our late fellow member, Mr. John Wright Seaver, on the 14th day of January, 1911, this Society has suffered a loss and our profession a capable man. That we extend to his widow and to his family our sincere sympathy. That a copy of the Memoir as printed in the Transactions be forwarded to his family, and that this Resolution be printed in the minutes of this meeting of our Society.

MEMOIR.

Mr. John Wright Seaver was born in 1856 at Madison, Wisconsin. While he was yet very young, his parents removed to

Buffalo, New York. At the early age of 13 years, he entered the machine shop of the Shepard Iron Works there. He studied in night schools at the same time, walking three miles each night, and back, to reach his school. In two years, he was transferred to the drafting room.

At the age of 18, he entered the shop of the Howard Iron Works, and at 20 he was made Assistant Superintendent of these works, employing 1,000 men. He was engaged in designing and building marine engines—notably, those of the Great Western.

Leaving this last company, he formed the partnership of

Seaver & Kellogg and built the first steel railroad cars in this country. He next joined the force of the Kellogg Bridge Works, where he specialized in bridge construction. He became Chief Engineer of the Iron City Bridge Works, of Pittsburg, in 1880. Four years later, he was Chief Engineer of the Riter-Conley Co. He here became celebrated as a designer and builder of blast furnaces, steel works, oil refineries, buildings and other steel structures.

In 1896, he united with S. T. and C. H. Wellman to form the Wellman-Seaver Co., which later became the Wellman-Seaver-Morgan Co. While with this company, he was Vice President, and remained a director until his death.

Some five years ago, he began a consulting practice in this city, associated with Mr. James E. A. Moore, which continued until the close of his life.

His death occurred very suddenly at his home on Norfolk road, on Euclid Heights, Cleveland, on January 14, 1911, and was due to apoplexy. He had been in poor health for a few months. He leaves a widow and four children. Two of his sisters and his mother survive him.

Of his professional work it may be briefly said that by his own efforts and under discouraging circumstances, he mastered the scientific principles of his calling and used them effectively in many diverse directions. His work of designing and building marine engines and bridge structures has been mentioned. He was the first designer and builder in this country of the Gantry crane. He designed much ore and steel handling machinery. He was an expert in, and an authority upon, the subject of coke oven machinery. He used novel methods in launching some lake vessels. He was interested in architecture and in building designs.

He was a member of the American Society of Mechanical Engineers, the American Society of Civil Engineers and of the Cleveland Engineering Society.

Minutes of Meetings

Regular meeting, Oct. 11, 1910, at the club rooms, called to order by President Frazier, at 8:00 o'clock P. M.—Present, 78 members and guests.

Minutes of meeting, Sept. 13, 1910, read and approved.

The President read the report of the tellers, declaring each man proposed for membership at meeting, Sept. 13, elected to his respective class; also that the amendments to the Constitution, proposed at the same meeting, carried.

Upon recommendation of the Finance Committee and unanimous approval of the Executive Board, a ballot was ordered prepared for the transfer of $1,300.00 from the Permanent Fund of the Society to the Commercial Fund, said ballot to be canvassed at the next regular meeting.

Upon motion, duly seconded, the Secretary was instructed to read the names, addresses, present business connections, and names of endorsers of applicants for membership, which had been approved by the Executive Board since the last regular meeting of the Society, and thereupon read the following names:

For active members:

L. S. Baird	R. W. Deucher	F. A. Little	F. A. Scott
J. L. Bartlett	P. H. Douglas	E. McGeorge	H. T. Simmons
R. F. Bell	E. W. Gebhardt	C. S. McGill	J. C. Spencer
C. W. Benjamin	E. F. Gibbons	E. K. Miller	J. L. K. Snyder
W. R. Brewer	H. C. Hale	J. J. Murray	J. H. Stratton
B. W. Bugbee	Paul Justus	Oscar Paullin	I. D. Thomas
G. W. Burrell	H. J. Kidd	H. B. Prather	J. F. Tufel
F. M. Canfield	E. E. Kinnison	K. H. Pratt	J. M. Walsh
A. F. Case	C. W. Larner	S. R. Sague	C. C. Williams

For associate member: A. E. Brown

For corresponding member, E. R. Russell

and upon motion, duly seconded, the Secretary was instructed to prepare these names for letter ballot to be canvassed at the next regular meeting.

The paper of the evening was given by Mr. A. M. Felgate, County Bridge Engineer, on "The Rocky River Arch," illustrated with lantern slides, showing many interesting views of this bridge in course of building. Following the reading of the paper, Mr. Felgate answered many questions concerning the bridge and the work in connection therewith.

Upon motion, duly seconded, a vote of thanks was tendered Mr. Felgate.

Adjourned.

F. W. Ballard,
Secretary.

Special meeting, Oct. 24, 1910, at Technical High School, called to order at 7:45 P. M.—Present, about 60 members.

Prof. Barker, principal of the School, addressed the meeting on the work, aims and possibilities of the intermediate technical school. At the close of his talk, the members were shown through the various departments, returning to the main auditorium after the trip, when Mr. Barker answered many questions concerning the school in general and the requirements for entrance.

Upon motion, duly seconded, Mr. Barker was tendered a vote of thanks not only for his invitation to visit the school, but also for his interesting and instructive talk.

Adjourned.

F. W. Ballard,
Secretary.

Regular meeting, Nov. 8, 1910, called to order by President Frazier at 8:30 P. M., in the Chamber of Commerce Library.—Present, 141 members, ladies and other guests.

Upon motion, duly seconded, reading of minutes was omitted.

The Secretary was instructed to prepare letter ballot to be canvassed at the next regular meeting, for the following applicants:

For active members:

Albert M. Allen	Antoine B. Du Pont	Jesse G. Melendy
Joseph P. Bayne	Francis N. Gilliland	John F. Oberlin
Arthur N. Doud	Edwin S. Griffiths	Willard N. Sawyer

For associate member: Charles E. Cole.

For corresponding members:

Walter H. Hollstein — William H. Thomas

President Frazier read the teller's report and declared the unanimous election of the entire membership ballot, published at the last regular meeting, and also announced that the ballot for transfer of funds had carried with but one dissenting vote.

Mr. Kinney, President of the Chamber of Commerce, welcomed the Society to its new quarters in the Chamber of Commerce building, and his remarks were appropriately replied to by President Frazier.

"An Evening with the Planets and Stars" was the subject of an address by Mr. W. R. Warner, President of the Warner & Swasey Co. Mr. Warner's address was illustrated with many lantern slides, and was exceedingly interesting and instructive.

Also, there were appropriate remarks by others relative to the future of the Society and its possibilities, and some pointed notes from the Chairman of the Finance Committee, read by the Secretary.

A light luncheon was served and the members and guests retired to the fourth floor to inspect the Society's new quarters.

Election returns were received throughout the evening.

Adjourned.

F. W. Ballard,
Secretary.

Library

The cases in the Library have now been arranged and the books placed in the cases so as to be readily located.

Works on Structural and Railroad Engineering will be found at the east end of the stacks in the main reading room. In this room will also be found the Transactions of various Societies, and the Periodicals, and at the west end the Indexes.

In the Committee room along the west wall will be found Electrical, Mechanical and Hydraulic works; also the *American Architect* and other periodicals, and Government and State Reports.

The Library Committee is greatly indebted to Mr. F. E. Bissell, Mr. S. E. Roof and Mr. R. L. Tappenden, for their assistance in the work of arranging the stacks and books in the Library. We like volunteers, whether they contribute their services or books and periodicals.

Through the kindness of Hon. J. H. Cassidy, M. C., and Hon. Paul Howland, M. C., the complete Bulletins of the Census Bureau and Statistics of Railroads compiled annually by the Statistician of the Interstate Commerce Commission, have been received.

The *Canadian Engineer,* the principal technical Journal of our friends across the Lake, has joined the ranks of RECIPROCITY and become an exchange of the JOURNAL.

Those of our members, who are interested in Aviation, will find the *Air Scout,* one of our new exchanges, a live Journal. It is the official organ of the United States Aeronautical Reserve.

Through the kindness of Mr. E. E. Hart, Mr. Willard Beahan and Mr. F. E. Bissell, the Library is now in possession of a nearly complete set of the *Cornell Engineer.* If some alumnus will contribute the volumes for 1898 and 1902, the set will be complete.

Mr. E. E. Hart has presented several volumes of the *Railway Age Gazette* to the Library.

We would be glad to receive from some Cornell alumnus, back numbers of the *Sibley Journal of Engineering.*

Library Committee.

G. H. TINKER, *Chairman*
R. H. FERNALD
WILLARD BEAHAN

BOOK REVIEWS.

A Manual of the Principal Instruments used in American Engineering and Surveying, manufactured by W. & L. E. Gurley, Troy, N. Y.

Forty-Fifth Edition, 1910. Price 50 cents.

The Forty-Fifth Edition of Gurley's Manual contains 516 pages. The first half of the book forms a manual of instructions in the use and care of the principal instruments, including the transit, solar, level, plane table, current meter and others. There are also tables of refraction, and reduction tables for use with current meters. The descriptions are clear, the illustrations good, and the instructions concise.

The last half of the book is a catalog and price list of instruments, drafting tools and supplies, and includes an eight-page index. The whole forms a reference book, which should be in every engineer's library.

Physical and Scientific Instruments, W. & L. E. Gurley, Troy, N. Y.

In connection with the manufacture of Civil Engineers' and Surveyors' instruments, Messrs. W. & L. E. Gurley have established a department for the production of Physical and Scientific apparatus of all kinds. In the 260-page catalog, under the above title, is described all kinds of apparatus for college and commercial laboratory equipment. These are grouped under the heads of:—

Accessories for Laboratory Use
Rods, Supports, Clamps
Mechanical Laboratory Apparatus
Vacuum Pumps
Optical Apparatus
Apparatus for the Measurement of Induction
Electromagnets and Accessories
Magnetometers, Inclinometers, Variometer, Earth Inductor
Keys for Electrical Testing
Galvanometers
Wire and Carey-Foster Bridges
Electrical Resistances, Resistance Boxes, Wheatstone Bridges

In the part on Accessories for Laboratory Use is described a useful assortment of supports, specially adaptable to various kinds of work and readily interchangeable.

The original idea is due to Prof. S. W. Stratton, Director of the National Bureau of Standards. An appendix to this part illustrates some of the uses to which they are adapted.

A Handbook for the Use of Sealers of Weights and Measures, W. & L. E. Gurley, Troy, N. Y.

Third Edition, 1910. Price 50 cents.

The first 66 pages of this work contain a complete manual of the duties of a sealer of weights and measures. Detailed instructions are given for inspecting, testing and sealing all types of scales and measures, with many hints as to methods of falsifying to be looked for.

The next 80 pages contain descriptions and prices of standard measures and sealers' equipment; then follow 41 pages of tables, tolerances, metric equivalents and capacities of cylindrical measures. A 6-page index and a few blank pages for notes complete a very useful and handy volume. The size is such that it may readily be carried in the pocket.

Membership Committee

The Membership Committee has been earnestly striving to meet the expectations of the management of our Society, but still finds itself a long way from the goal. Our President wanted the membership doubled, but the Membership Committee considered this almost too arduous a task unless the co-operation of every individual member of the Society could be depended on. It was deemed possible, however, by consistent effort, to raise the membership to *500 Active Members* in good standing, not counting the Honorary Members, the Retired Members, and the Associate and Corresponding Members, allowing the latter to make up for any slight fluctuations.

To date, there have been received 126 applications for membership in the current fiscal year, which started with a membership of 311. It is conservatively estimated that there are 1,500 men in Cleveland eligible for membership in our Society, and that our rolls should contain the names of at least half of that number.

Every man on the Membership Committee has exerted himself reasonably well with reference to the task assigned, and there is not one man on the committee who has not "landed" two or more members, saying nothing of the numerous calls each has made, and the many prospects he has "dug up".

Such loyal interest has not been confined to the Membership Committee, however, for the efficient co-operation of President Frazier, Secretary Ballard, Assistant Secretary Black, and Treasurer Ranney, supplemented by the splendid work done by Messrs. M. C. Canfield, J. E. Washburn, Geo. F. Burrows and many others, has been a source of inspiration and encouragement, and merits equal recognition by the Society.

Furthermore, the present Membership Committee has had the benefit of a good list of prospective members which was originally prepared by Mr. C. H. Wright, when he was in charge of membership work. This list was compiled very carefully from the personal acquaintanceship of each committeeman, from various lists of technical Societies with representatives in Cleveland, from directories, etc., and was later revised and augmented by a subsequent Membership Committee, of which Mr. H. M. Lucas was Chairman. At the beginning of the present fiscal year, Secretary Ballard carefully went over the list mentioned, the Chamber of Commerce list, etc., and after a lot of painstaking effort, succeeded in making up a list of about 750 prospective members.

In spite of all this evidence of progress, it is very obvious that unless *EACH MEMBER takes a personal and active interest by BRINGING INTO THE SOCIETY AT LEAST ONE NEW*

MEMBER before June, 1911, we will not be able to present the report at the Annual Meeting, which we sincerely hope to be able to submit.

We have yet three months to "make good" in, and most earnestly solicit the assistance of every member.

We feel that we have a splendid object to work for, and are not selfish enough to keep it to ourselves. We want every eligible man to have an invitation to join our organization, not only because we have something "worth while" to offer him, but also because we want his influence, company and co-operation, if he is a good man.

It may not be out of place here to present some extracts from an article "On the Ethics of Society Membership", which appeared in the Journal of the Ohio Society of Mechanical, Electrical and Steam Engineers, May, 1909.

"To one familiar with the struggles necessary to maintain the affairs of a society in business-like shape, it becomes very apparent that the average man does not recognize the obligations he has assumed by affiliating with such an organization. We understand a "Society" to be an organization composed of people working for a common end. "Ethics" conveys the idea of a set of principles or rules concerning moral obligations intended to regulate the practice or conduct of individuals in a particular sphere of activity.

"*Membership* should be *prompted by two motives:*—(1) To *impart* to others the benefit of one's experience and knowledge. Such service appeals to good men, who are vitally interested in enhancing the standing of their occupation or profession, and incidentally offers a medium, whereby ability and merit will receive just recognition if a favorable impression is made by the manner in which a man handles and presents a subject before a meeting, or by the form of a paper as it appears in the publications of the Society. (2) To *receive* such knowledge and social benefits as can be enjoyed, due to the altruism and enthusiasm of others engaged in the same or kindred pursuits.

"Not to all is it given to win laurels through the brilliant presentation of timely subjects before a Society, yet each member can do some one thing and do it creditably, and almost all can contribute to the informal discussion of a paper. No good man is ever at ease when riding along as a 'dead head passenger'. *Virile men want something to do* and our Society has a place for every one. A Society to prosper must have 'Esprit de Corps', which is productive of good 'team work'. Who does not know of the powerful influence of 'college spirit', 'town spirit', 'national spirit', 'patriotism'? All these designations mean practically the same thing; a manifestation of *live interest* and zeal, flavored with wholesome enthusiasm, on the part of 'individuals working for a common end'.

"*Leadership* has very much to do with this 'Society Spirit', and in this respect our organization has been very fortunate. From its small beginnings it has enjoyed the leadership of able and

unselfish men, devoted to the Society's best interests. It is for the membership to respond and pass the word along; and, if all catch the spirit, the Society will *gain* at a rapid rate, both *in membership and influence.*

"The standard of any organization is practically the standard of its average member, and the Society is judged (1) by the character and standing of the individual members composing it, and (2) by the work it does (they do). The latter consists of the work of the committees and individual members in solving problems, establishing working standards, etc., and throwing light upon subjects not clearly understood.

"Secretaries are frequently consulted concerning the character, ability and general standing of members who may apply for, or who may be considered for desirable positions. Naturally, the secretary's opinion is largely influenced by the manner in which such candidates meet their obligations, moral and financial, and the dispatch and efficiency with which they perform assigned or assumed tasks.

"In fact, it is well to remember that whatever is worth doing at all is worth doing well, and that whatever is done can be made a desirable or undesirable part of one's biography, to be controlled largely by the individual himself.

"It seems a paradox that in many Engineering Societies, including our own, provision should be made in the constitution for 'delinquents' to be 'dropped' if in arrears over a specified period. Engineers are expected to be men of principle, because their very work trains them in habits of accuracy, regularity and neatness, and with the consciousness of mastering laws of nature and of knowing 'how to do things', there comes legitimate self-respect as well as the esteem and confidence of associates and of the community. Carelessness, indifference, indecency, etc., are never characteristics of a good engineer, because they will not harmonize with ability and reliability. How self-respecting men can allow themselves to be classed amongst 'delinquents' is inconceivable, since everyone knows that all honorable men try to meet assumed obligations promptly and courteously, or else offer explanations why they cannot do so, and do not by their actions demand that their names shall be dropped from the roll of their Society. When, for any good and sufficient reason, they cannot or do not care to retain their membership in the Society, they should resign, *after meeting all obligations to date.* No man who cares anything about his reputation can afford to do otherwise, making due allowance, of course, for uncontrollable limitations, whether these be personal weaknesses, like forgetfulness, or inevitable outside circumstances. It is entirely within the jurisdiction of the Executive Board to satisfy or waive the payment of dues of desirable and loyal members, who for a time are unable to meet their financial obligations and who so advise the proper officers, and such matters can be handled gracefully without receiving publicity to the embarrassment of the beneficiary. A new director is soon

to be published and this should contain no names except those of men who are a credit to the Society and the engineering world.

"If the Society is to grow and to be active, every individual member must be active, and if the Society is to attain an increasingly higher standard, every member must hold himself to an increasingly higher standard, free the officers of the burden of writing dunning letters and of worrying about finances and let them give their best efforts to the highest interests of the Society and to its expansion!

"Let every reader consider this a personal matter and manifest *interest* and ambition by *participating in some form of effort* for the good of the Society.

"Membership work is the best kind of a starting point."

Some of the material reprinted has no direct bearing on the appeal of this article, but involves some principles which we should follow out more in our work, and it may be construed a part of the work of the Membership Committee to disseminate such knowledge and to hold up such standards of membership obligations.

Thus each member of the Cleveland Engineering Society is hereby informed that the Management and the Membership Committee are expecting that HE SHALL BRING IN ONE NEW MEMBER BEFORE JUNE 1, 1911. If you have no one in mind, call up Mr. Black at the rooms, Main 1807, between the hours of 11:30 and 5:30 any day and ask him for names of prospects.

DO IT NOW.

Membership Committee.

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H. E. Hackenberg

Employment Bulletin

This Department is for the use of members desiring positions or requiring engineering services. It is under the personal direction of the Secretary, who is anxious to increase its value to the members; therefore, if you are in need of engineering help, or desire to secure a position, do not hesitate to call on the Department for assistance. The information is handled confidentially.

POSITIONS VACANT.

No. 3V. Mechanical draftsman for detail work; preference given to man with marine engine experience; good position and opportunity for man with desired qualifications.

MEN AVAILABLE.

No. 3A. Age 31; Case School 1904, M. E.; ten years' experience, covering various lines, including tools, engines, mining machinery, coke oven machinery, material handling machinery, and factory buildings; desires place of some responsibility, not at drawing board, preferably in the commercial side of engineering.

No. 4A. Case School student; one and one-half years' field work in Peru, S. A.; six months with level and one year as transit man—railroad work; also six months on location work as instrument man in Uraguay. Desires position as leveler or transit man.

Practical Points

Department of Marine Engineering.

"Business is business" usually refers to a cold-blooded relationship, in which one party presumes to offer compensation to another for "value received". Sentiment and personal considerations are supposed to be ignored in the transaction, each party considering itself under bond to get the most for the least expenditure of time, effort and money.

Nevertheless, experience demonstrates that a mere sense of duty will never induce men to act with snap and spirit, to the degree which a feeling of pleasure, added to the claims of obligation, will prompt in the handling of assigned tasks.

So there is often a good place in business for an expression of a cheerful disposition, a personality gifted with humor and wit, which expression may do much to nurture mutually enjoyable and profitable business relations, and such an agency demands respect, per se.

The following is an example.

A business man, detained by several days' illness from attending properly to his correspondence, wrote a concern, apologizing for the apparent negligence on grounds of having been "laid up in dry-dock, undergoing necessary repairs," etc. He received a reply, from which an extract is herewith reproduced:

"I sincerely hope that all your loosened plates are tightened up, seams caulked and defective rivets replaced, wrinkles hammered out of your deck-plates, your fan tail strengthened and the stem re-enforced; also that the garboard strake is on an even keel and your bilge working satisfactorily. In the meantime, not having my nautical dictionary at hand, I have run out of terms that smack of the sea."

The business man, who already had a high regard for the writer of this unique bit of prose, respected him the more afterwards as a versatile individual, conversant even in realms outside of those in which he is making his "bread and butter".

In this particular incident, even if the delay referred to had caused annoyance, neither party could "get mad, even if he tried."

Draw your own conclusions and keep them to yourself.

Personal Items

Mr. J. F. LeBaron has just returned to Chardon, Ohio, after an extended stay in the vicinity of Ipswich, Mass., where he has been engaged in the study of conditions on some 1,500 acres of drifting beach sand, salt marsh and cranberry meadows, which it is desired to reclaim and improve. Mr. LeBaron was aided in his research work by the United States Government, which is looking forward to Harbor Improvements along the lines suggested by him, early next season.

Mr. M. A. Munn, who has had charge of some work in this city for Mr. J. D. Rockefeller, has been transferred to Pocantico Hills, N. Y., Mr. Rockefeller's summer home, where he will be located for some time.

Mr. A. B. Roberts, recently with the Standard Welding Co., of this city, has accepted a position as systematizing engineer with the American Fork & Hoe Co., present headquarters at Jackson, Mich.

Mr. Boyd Lesh, who has been in the employ of the Brown Hoisting Machinery Co., has accepted a position with the Tennessee Coal, Iron & Railroad Co., Ensley, Ala.

Mr. J. E. A. Moore, former associate and consulting engineer with John W. Seaver, is now chief engineer of the C. O. Bartlett & Snow Co.

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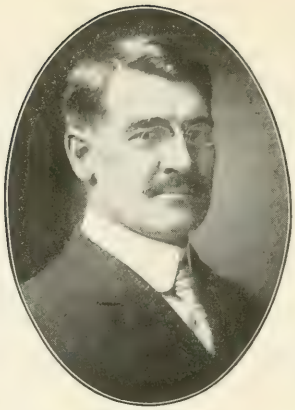

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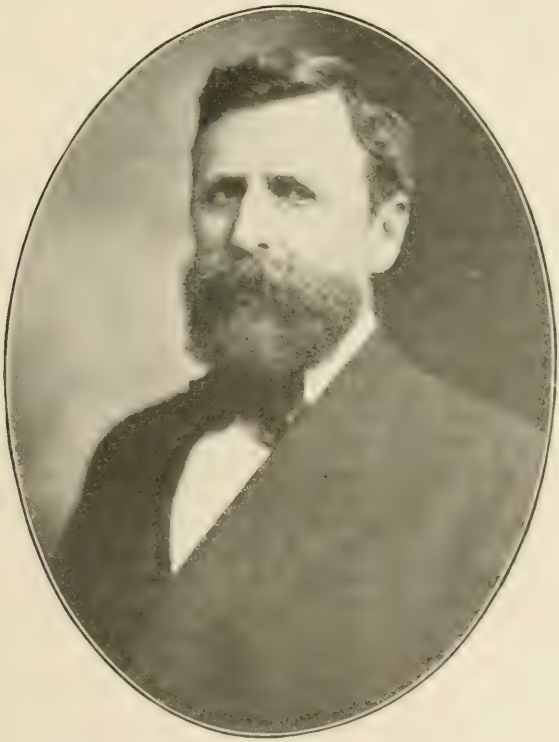
River and Harbor Improvements

By Isham Randolph
(Address at Annual Banquet.)

Mr. Toastmaster, Mr. President, and members of the Cleveland Engineering Society, and guests, after such an apocryphal introduction as this, I am afraid I am too completely upset to be able to talk about harbors or anything else. The idea of my having been sent to discover Chicago is most astounding. I was sent there by Mr. John Garrett, a good many years ago, to build



Isham Randolph

the B. & O. Railroad, and I waded through those marshes of which you speak.

Gentlemen, it is with very great pleasure that I meet with you this evening. I feel very highly complimented by the invitation, but I also read this topic with no little trepidation. For I have before me so many men who have been engaged in the work of city and harbor building and doing those great things that make our land the great and glorious country that it is, that I feel a diffidence in speaking to them.

I have been asked to speak of harbors, of the Cleveland harbor. I have had to do with harbors for a great many years. My first connection with harbor work was in 1882, when I took part in building the first docks on the Calumet river, south of Ninety-second street. Later, in 1892, a commission was formed to study the harbor and terminal needs of the city of Chicago and to visit the other cities of America and see what they had done, and to garner from their wisdom things which might help us in our need. I was a member of that commission. We worked hard upon our problem. We prepared a report, a good report it was. We prepared two reports; one was a minority report. I wrote the minority report. But Chicago, heedless of the wisdom which had been cast at her feet, went on her old way, doing nothing to retain that great commerce which had come to her through her geographic location. The old river was good enough for her, she wouldn't build any docks, she wouldn't do anything which would bring commerce to her. Her motto seems to have been, "I am so big they have got to come to me, and let them get here the best way they can." Years went by. Chicago river began to lose its commerce. One by one the elevators on the south branch were torn down, or destroyed by fire and not rebuilt, and in the last ten years ten great elevators have disappeared from the south branch of the Chicago river. The Great Western Indiana elevator, which I built in 1881, is being torn down today because there is no business for it, and the land is needed for tracks. Two years ago, the mayor of Chicago, along with many other citizens, felt that something must be done. He organized another harbor commission. This commission was composed of three engineers, one of them a railroad President, several members of the City Council and one attorney. I was on that commission. We worked hard. We gathered a vast amount of valuable information. We sent a competent man abroad to study the harbors of the old world and report to us what he had learned, to bring back to us the fruits of the labors of our European friends.

Another report was written, a voluminous report, a report covering every phase of the harbor problem, but a report which recommended no definite action. There was another minority report written—I wrote the minority report. Now, gentlemen, don't think that I am an off-ox, always kicking. I am always in accord with the other fellow when he is right. But this second minority report, which I wrote, didn't appear in print, because my comrades made concessions to me, provided that I wouldn't publish it.

Chicago's need is growing more intense every day. We have expended upon the Chicago river about ten and a half million dollars in a stretch of five miles. Ninety per cent of the work which we have planned has been completed. We have made that river 200 feet wide, and the central 100 feet of that width is 26 feet deep. But commerce does not come back to us. Why? That river is spanned by bridges too numerous to make it comfortable for the modern freighter to traverse its winding way.

In other words, Chicago cannot put her harbor at her back door. The vessels will not go into the back yard to do business; and, gentlemen, you in Cleveland are afflicted with a back yard. Unfortunately for you, great industries have sprung up on the inside of your city, along a crooked, tortuous stream. Great investments have been made there, investments so great that they cannot be abandoned, and the commerce which reaches those industries must crawl up your tortuous stream, must contend with your bridges, must contend with all of these difficulties, with which you are so familiar.

I first became acquainted with your river on the twenty-first day of October, 1909. On that day I made a trip very similar to the one which we have made today. I saw then some of your difficulties. On that day I met, for the first and only time, a man who has filled so large a place in the history of Cleveland that you must know to whom I refer, your then mayor, Tom Johnson. I never met him before, I never met him afterwards, but he was a man who appealed to me, a man of big brain and a big heart, of broad instincts; I don't know how you feel towards him as a mayor or as a politician, but I can but believe that there is not a man in this audience who does not regret the loss of such a citizen to the city of Cleveland. I talked with him about your harbor, and at his request wrote him a letter, giving a brief outline of my own ideas. But, as I said at luncheon today, he is a rash physician who attempts to prescribe with a superficial diagnosis. I cannot prescribe for Cleveland, but I could only wish that there were a Baron Haussmann for Cleveland, that man who was born in 1809 and who came into power with Napoleon III, a man who had the courage to destroy and the genius to build up, and who had back of him the power to sustain him in his work. That work which redounded to the beauty and the glory of Paris. I wish that you of Cleveland had some such man who was ready to take hold of the situation here, tear out the old, make new ways for your commerce and bring about a condition such as you ought to have. As I looked over that river today, it seemed to me that there were possibilities there, that if some strong hand took hold of the situation and mapped out what ought to be done, arguments could be brought to bear upon those in possession, which would prove to them that a new order of things could be brought about which would benefit them and benefit the city of Cleveland. Your industries are located in the interior of your city. As I said before, too much money has been spent there to abandon them, but they should not be handicapped as they are, they should not have to pay a differential to get their raw material into their factories. The straightening and widening of your river would be a boon to them, would be a boon to your lake carriers, and I believe that you can bring about a condition which will greatly benefit this river. You are now snipping off a corner here, straightening a bend there, but you are simply giving slight relief to the situation. As I saw those big vessels crawling up the river today, I was reminded of the Philadelphian, who was dining with a friend at Delmonico's,

They had snails for their dinner. The Philadelphian had never seen them before and he was very much pleased with them. He said, "What are these?" The other said, "These are snails, don't you have them in Philadelphia?" "Oh, yes, we have them there, but, you see, we can't catch the little devils." (Laughter.) Well, these big devils were crawling up that river mighty slowly today.

But you have a situation here in Cleveland, which any city might be proud to have. You have a lake front, you have three miles there which the government is protecting by breakwater. This is the proper location for your harbor. Here you can make a port, into which your lake carriers can come under their own steam, they can discharge and take on their cargoes without loss of time, for time means money to the lake freighter, as it does to every industry. There you can make provision which will make your city second to none in its harbor facilities on the Great Lakes.

I have contended and still do contend that no harbor is of the value that it ought to be to a city unless every railroad entering that city can reach it upon terms of equality. Here you have the opportunity to do this, you have the opportunity to bring your railroads into this lake front area in a way which will not interfere with your city traffic. This I have urged for Chicago. I have found but one place there, where all the railroads entering the city can be assembled without constricting the street commerce of the city, and that is the stretch between Sixteenth street and Forty-first street. There is three miles which, I believe, the city of Chicago should have for its commerce and not give up the whole of its 21 miles of lake front to parks and to pleasure. As man cannot live by bread alone, so can no city live by the beautiful alone, but there, the advocates of beauty have gotten a law through the legislature which gives to the parks the entire lake front, not now actually occupied by commerce, and the part actually occupied by commerce is infinitesimal.

Your future is in your own hands. It depends upon your wisdom, your energy, your pluck. You have here advantages as a manufacturing city possessed by few others. In fact, reading the statistics which your President so kindly sent me, it seems that here at Cleveland the raw materials can be assembled more cheaply than at any other port on the Great Lakes. Trusting that your patriotism, your wisdom and your courage will be equal to this task, I thank you for your patience in listening to me, and wish you success in all of your great undertakings. (Applause.)

The Value of Engineering Co-operation

By S. E. Doane.

The engineering activities of this country are broadly grouped as civil, mining, mechanical and electrical. These four groups have national organizations, and these bodies, together with various local societies, devoted to specialized branches of the four general groups, represent a total membership of over 40,000. The importance of the work which this army of trained engineers direct is too well known to need any comment.

The engineering organizations have given more or less attention to the ethics of their profession, and to a study of the relations which exist between their members and the public. The references appended given in the announcement of this meeting present some excellent thoughts upon this phase of engineering co-operation and are worthy of careful study. The opportunities which are afforded for co-operation between the civil, mining, mechanical and electrical engineers are comparatively few. When such an opportunity is offered, it is one of wide-spread importance. Such for example was the reason for the joint meeting of the four societies on the Conservation of National Resources, on March 24, 1909. Engineers should never let pass a matter of so great importance to the profession without taking an active part in its discussion and doing their share to effect its proper settlement.

Engineering has been called the "Silent Profession". The modesty of the engineer is well known, and this quality has done much to depreciate his profession in the public mind. He is loath to assume activity in public matters and, in consequence, general management is assumed by men less fitted for the work, but possessed of the self-assertativeness the engineer lacks. Ultimately the engineer is called upon to exercise his ability upon particular matters, but in place of being in a position of authority, he is more or less subordinated, and consequently, hampered in the execution of his work and deprived of the credit due him.

John A. Bensel, President of the American Society of Civil Engineers, in his presidential address, covers this matter very pointedly as follows: "To be effective, however, we must be cohesive, and thus be able to take our part not as the lead, but as leaders, convincing the people, if possible, that all the ills of our social system cannot be cured by remedies which neglect the forces of creation, and that the best doctors for our trouble are not necessarily those whose sympathies are most audibly expressed."

While there are undoubtedly great benefits to be derived from a general co-operation on the part of all engineers to bring about a fuller appreciation of the importance of their calling on the part of the public, the benefits that can be derived by private co-opera-

tion between engineers representing the great manufacturing industries, can result in even greater benefit to the public and to themselves as engineers. This is true because there are a thousand opportunities offered for engineering co-operation in industrial affairs, to one involving public or legislative matters. Engineers are primarily engaged in production. To adapt the finished product most perfectly to the needs of the user, is to increase the effectiveness of engineering efforts and to enhance the public benefits derived therefrom.

Engineering co-operation in the industrial world results primarily in eliminating the useless, and in standardizing the useful. Such elimination would ultimately, by a slower process, take place through "the survival of the fittest", but it would then necessarily be accomplished with an enormous economic loss, and it would bring about a general retardation of the several industries involved. Naturally, both producer and consumer would suffer in consequence. Through engineering co-operation, we reach a harmonious correlation of parts in the shortest possible time and with the least economic waste. The costly experiment of bringing together several absolutely independent pieces of apparatus of different manufacturers in an effort to produce a concordant whole, should not be left to the consumer, but each manufacturer should so adapt his product that it can be used interchangeably, and with the greatest satisfaction, in combination with other apparatus, as the consumer may desire.

This can mean but one thing—engineering co-operation between producers to standardize the fundamental dimensions and ratings of the various goods or pieces of apparatus which are more or less mutually dependent upon each other for efficient service. The necessity of such co-operation exists in every industry, but not always to the same degree. The need of such standardization and engineering co-operation is felt most where several pieces of dissimilar apparatus must be assembled by the purchaser to form a complete unit.

In many cases the ultimate consumer is non-technical and cannot experiment to determine the most efficient combination of parts for his particular needs. Money expended in engineering and in development by the manufacturers, is much more efficiently expended in placing suitably designed apparatus before the consuming public, than it would be if it were expended by individual consumers to adapt the apparatus to their own particular uses. For example, large consumers could, through their engineering staffs and at their own expense, properly co-ordinate several pieces of apparatus not particularly designed for efficient mutual service, but the small non-technical consumer must put his parts together much as he finds them. He is the one to benefit most through co-operation on the part of the manufacturers.

It is particularly necessary, therefore, that engineering co-operation shall exist in industries where the products are widely distributed among non-technical consumers. Such co-operation also insures proper use of the several parts even when put together by non-technical consumers. Since it is only through the

proper use of any piece of apparatus that the highest efficiency and greatest satisfaction are produced, the benefits accruing to the manufacturers who have thus co-operated to give the consumer an efficient and satisfactory installation are obvious.

The engineer occupies an intermediate position between pure science and art. Pure science has to do with laws. A pure scientist may be a physicist, he may be a chemist, or he may devote himself to any one of the other numerous branches of knowledge. The pure scientist searches for knowledge, and is not concerned in the application of it. Art, whether it be fine art or liberal art, applies the laws of the scientist as they are interpreted by the engineer. It is the engineer who shows the artist, or artisan, where and how he may definitely apply the laws discovered by the scientist.

Facts are not debatable. Debate can only apply to deduction or reason. A law once recognized and definitely proved to be what it is supposed to be, is beyond all debate. There may be discussion as to whether a scientist's statement of a law is a true statement of that law, but once it is conceded that a law is accurately stated, all debate thereon ceases.

Debate is within the province of the engineer. The engineer has knowledge of many laws. The best way of achieving an end is open to debate. Whether it be a question of applying one law or another law, or whether it be a question of method or of material, the matter is within the province of the engineer, and it devolves upon him to debate with himself and with his fellows the various phases of the problem so that the final result will represent the best practice in every detail.

The ends of science are also served by co-operation. Such co-operation, however, must always be within certain definite limits; it may be in the direction of furnishing the necessary financial resources, or it may be in the direction of conserving the efforts of the individual. For illustration, men working along similar lines of scientific research, may divide the work among themselves so that their efforts result in the greatest amount of advancement; but there can not be co-operation in the sense implied in engineering co-operation.

Much engineering co-operation is voluntary. Witness, for instance, the general standardization of the bicycle, which was brought about by common consent. Much standardization in the automobile field is taking place in the same manner; also, we are witnessing a similar evolution in the aeroplane, where we find biplanes, monoplanes and triplanes. Common consent seems to have already eliminated the triplane, and in the end it is probable that the biplane and the monoplane will be used only for definite classes of service. For illustration, the racer may, by common consent, always be found to be the monoplane; whereas, it may be shown that there is increased stability in the biplane, and by common consent the biplane may be exclusively used for general touring or other duties which require heavy service, stability and less speed. These developments merely serve as an illustration, and lead up to what has been accomplished in the field in which the

author is particularly identified. Standard practice is the inevitable development of co-operation, whether it be by engineers or others, and it is evidence of co-operation which advances civilization. Co-operation implies civilization; competition is a relic of barbarism. In the realm of absolute barbarism, every individual is for himself, and co-operation is unknown. The first stage of community development requires co-operation; it comes about by common consent to protect the individual. It is interesting to notice that the growth of society, as well as the growth of engineering organizations, follows the same general lines as the growth of the individual. A little child is a barbarian; he is selfish and intolerant. As he grows older, he very gradually accepts the general principles of co-operation which he finds are already established. He is taught to be less selfish and to be more tolerant, and in this way he steps up to the level of his surroundings. In doing this, he, as an individual, is making progress, but he himself contributes nothing to the advancement of society. The frontier camp is not far removed from barbarism, but paralleling the development of the child, it gradually steps up to the level of its surroundings and finally takes on the higher attributes of civilization.

An engineer working alone suggests a higher type of barbarian. When he co-operates with others interested in similar work and organizes a society, he and his associates step up to the common level of existing engineering societies in other localities and other lines of effort. This, however, does not particularly contribute to general engineering advancement. It merely raises these individuals to the level of the age paralleling the condition in other branches of engineering. So it is with the engineers connected with an industry, and in more specific cases, with the engineers connected with a branch of the industry. This first stage of development was reached by the engineers engaged in electric lighting some years ago.

We return now to the child as the chosen symbol of development of co-operation. We find that the second stage of his advancement is reached as he matures, when, with a full knowledge of his previous development and the reasons for it, he exhibits initiative, and by deduction and pure reason, advances his own education to a point where he begins to take his share of the further development of society. The particular branch of electrical engineering, with which I am identified, has advanced somewhat in this second stage of development. In leading up to a statement of this advancement, the review just given will place the matter more clearly before you.

Your Secretary in giving notice of this meeting has mentioned my investigations in England and on the Continent. It was not my intention to speak so definitely of the engineering movement in other countries, as to clearly bring forward the idea that the lack of co-operative development along certain lines has caused me to think so seriously upon the subject indicated by tonight's paper. In America you are today, for the same expenditure of electricity or money, obtaining more light than is com-

monly obtained in any of the other countries where I have been. The individual engineers in England, France and Germany are of quite as high caliber as anywhere in the world. The quality of workmanship abroad, in which the plans of these engineers are expressed, is very high indeed, and the sole reason that the peoples of these countries are not obtaining so much light for their expenditures is that the great industries have not learned to co-operate to the extent that we co-operate in an engineering way for the general good. Unless the manufacturers of the sockets, shades and reflectors of the lamps co-operate, there can be only a limited amount of illuminating engineering.

Illuminating engineering is primarily interested in the correct use of light from the artistic, physiological and economic standpoint. The work of the illuminating engineer is of the highest importance to a community; it gives us well lighted streets, pleasantly lighted homes, magnificently illuminated shops and stores, and efficiently lighted offices and factories. The artistic side of illumination is equally important with the utilitarian side. The application of proper illuminating engineering principles makes both the hours of recreation and the hours of labor under artificial light more pleasant and more profitable.

Many are prone to regard the profession of illuminating engineering lightly. We must remember that 70 per cent of the income of our electric lighting stations comes from electric lighting, and that there is well over a billion and a half dollars invested in the central station industry, to say nothing of the enormous amount of money invested by the individual consumer in accessories for the distribution and utilization of light. An incandescent lamp is a small thing; it is sold cheaply, and yet it is the final means of utilizing this enormous investment in producing light. When we consider how seriously we debate on the efficiency of boilers, engines, dynamos, loss in transmission lines, etc., it is marvelous that so little attention has been given to the use of the one thing which transforms all this energy into light and represents the ultimate utilization of this enormous investment of capital, especially when we realize that good illuminating engineering practice will often increase the efficiency of a poorly designed installation several hundred per cent.

The illuminating engineer in every country but ours is hampered in his work by the fact that he has not a standard product to work with. An illuminating engineer abroad carefully lays out an incandescent electric lamp installation and specifies exactly what parts shall go to make up this installation in the way of shades, sockets, reflectors, etc., so that he obtains the illumination desired. When the first lamps installed begin to burn out, the user often replaces them with lamps so different from the lamps first installed that the entire value of the illuminating engineer's work is lost. It is not necessary to illustrate this condition in detail; it is true, and there can be no discussion on this recognized fact.

In the various branches of the engineering profession, every engineer must have standard products with which to work. The

civil engineer must know what his concrete will do. The mechanical engineer must have his standard sizes and qualities of metal with which to work. Just imagine the chaos that would result if, when certain materials or sizes were specified, you could not depend upon the art to furnish materials within 50 per cent of the requirements. The mechanical and civil engineer abroad has the same fine standard material to work with as he is supplied with in this country, but in the youngest of the engineering branches, electrical engineering, standardization is still lacking in the lamps and accessories which translate so vast an investment into useful product.

In this country our industry has reached many common standards by common consent, and the result is that both the engineer and the community are profiting therefrom. At first the incandescent electric lamps, made by the different manufacturers, were dissimilar in almost every respect. In the beginning the size of the units were different; one maker, for illustration, made 16-candle-power lamps, another 20-candle-power lamps, and another was a vigorous advocate of 12-candle-power lamps. By common consent we arrived in the case of the older lamps with the carbon filament, at a common basis of 16-candle-power.

At first the different manufacturers had different voltage standards, one manufacturer advocating a voltage of approximately 52, another advocating 80, another advocating a voltage of approximately 110, and still others advocating 220 volts. By common consent, the industry is crystallized to the voltages between 100 and 120. Originally, we had several kinds of bases with which the lamp proper was connected to the circuit. We had the Edison, Thompson-Houston, Swan, Westinghouse and many others. A few years ago, we had almost reached the standardization of the Edison base by common consent, and in advancing into the second stage of development, the engineers got together and by weight of their influence turned the country to the Edison base, which is now standard.

The discovery of the modern high efficiency lamp found the industry approaching the close of the first stage of their co-operating development. They were tolerant and cognizant of the efforts of others; in other words, they were ripe for the co-operation which would soon place them fairly in the second stage of development. Our co-operative bodies had grown in mental stature and the advent of the new lamp found them organized with an appreciation of their shortcomings. It is worthy of note that the first developments in the laboratories were as widely apart as possible. Before the first high efficiency lamp was placed upon the market, the electrical engineers, connected with the incandescent lamp profession, gathered together and decided to agree, for the common good of the industry and themselves, upon a certain definite standard of sizes and dimensions.

The author believes that this is the first instance on record where the engineers of competing interests have decided at the birth of a strikingly new development, that, for the good of the community and themselves, they would not wait for the elimina-

tion by common agreement of all but a few of the many sizes originally proposed. Education and previous experience had indicated that this would ultimately occur, and they agreed prior to going before the public that they would co-operate in determining the standards to which they would adhere, and thereby at one step eliminate the evolution from comparative barbarism with its consequent economic waste in their particular branch of the industry. The engineers of competing organizations can agree, for the good of all, to limit their competition to those things which, at the present stage of development of their industry, are still neces-

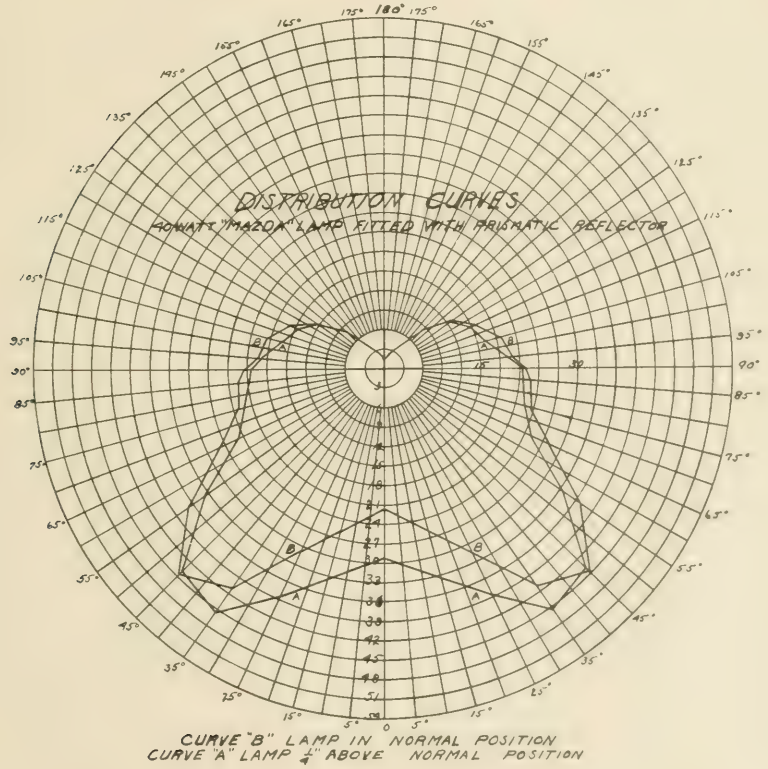


FIG. 1.

sarily competitive and eliminate from competition those things which are not necessarily competitive. Such a course cannot but benefit all.

To refer again to our own industry: When the high efficiency lamp was in the state of development, one manufacturer was considering a 35-watt tungsten filament lamp, and another was devoting his efforts to the development of a 70-watt size. The inevitable result of continuous development along these lines would have been that competition would have made it necessary for each manufacturer not only to furnish the size of lamp he

himself developed, but to develop and manufacture the sizes of lamps placed upon the market by his competitors. Eventually, after much expensive development and after establishing several nearly coincident standards in the industry, popular consent would have eliminated all but a few sizes. Not only the manufacturers, but the consuming public as well, would have suffered from much misdirected effort. The result of this was the standardization of only such wattages as the industry could conveniently use. From that time to this, we have co-operated in the development of standard sizes, adding both larger and smaller lamps. It

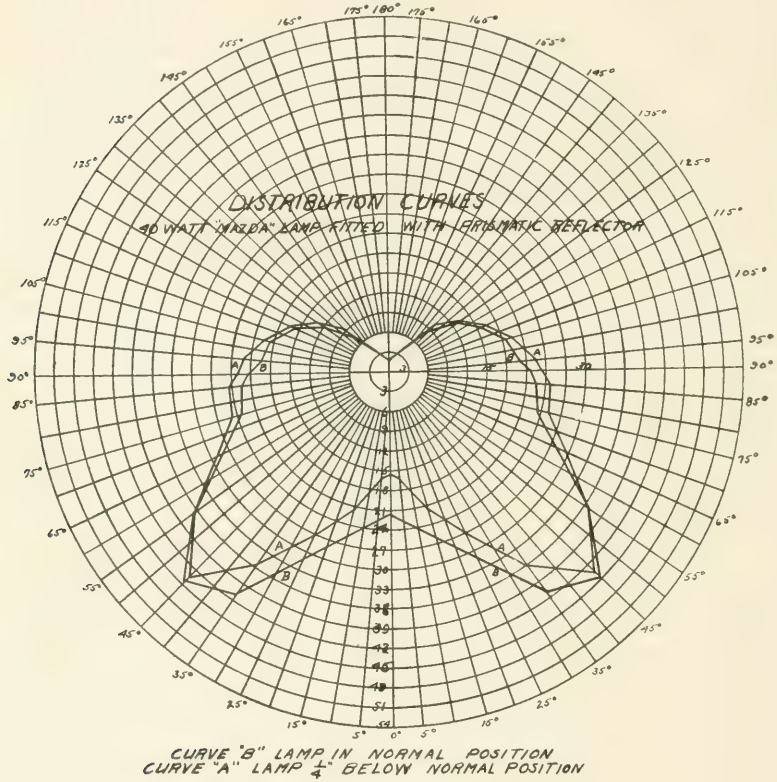


Fig. 2.

was only a step farther to meet and decide that our sizes of bulbs should also be standard. This, you will note, was still within the particular confines of lamp manufacture. However, it became evident to us that if we could go outside of our particular industry and in any way correlate the efforts of other industries, it would benefit ourselves as well as the community at large; so again we advanced in the second stage of development of our co-operative growth, and from this second step has sprung the remarkable developments of illuminating engineering so vigorous in this country and so weak in others.

In order to co-operate with the manufacturers of reflectors of lamps, it was necessary that we should standardize the position of the filament in reference to the base contacts of our lamps, to standardize holders which were attached to the lamp sockets and which supported these reflectors, and to standardize the reflectors themselves. Just why this standardization was necessary is indicated by Fig. 1. It is necessary that the center of light radiation of a lamp shall be in a certain position in the reflector so that the light procured from the joint operation of the lamps and the reflector, shall be distributed as predetermined. This figure shows the light distributed as predetermined, and also what the distribution would have been had the filament been ¼ inch too high. The next figure shows the comparison between a properly placed fila-

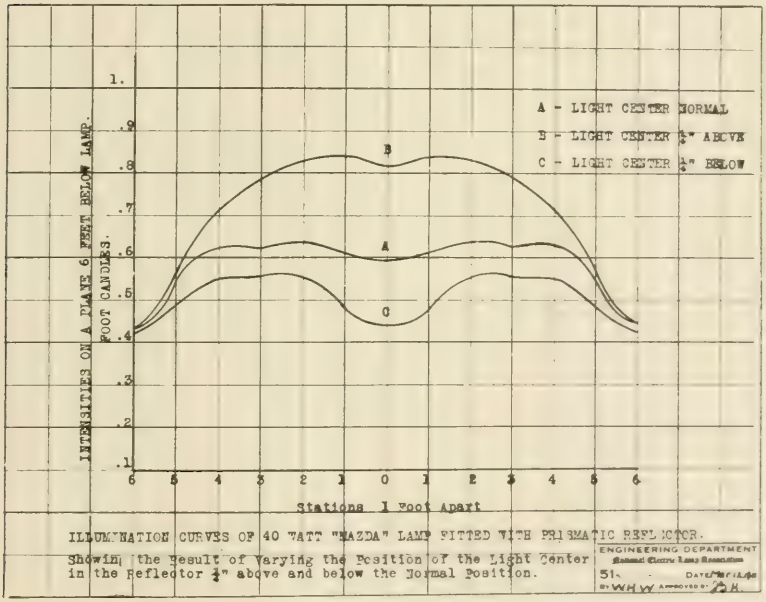


FIG. 3.

ment and one placed ¼ inch too low. It is a credit to the engineers and to the industries approached with this program of standardization, that they willingly went to the expense of many thousands of dollars in modifying and destroying expensive tools and apparatus in order to bring about the co-operation suggested by us. Fig. 3 shows the distribution of illumination which would have resulted had the filament been too high or too low.

It has been shown in the preceding figures what would happen if the light center of the lamp were displaced ¼ inch from its proper position in the reflector designed for it. There actually came under my notice in England, case after case where the light center was as much as 1 inch from its true position.

In order to bring about this result, it was necessary to deter-

mine standards, make gauges to maintain some of the standards once determined, and to reach exact understanding as to what was desired. Fig. 4 gives some of the dimensions and standards which we agreed upon on the type holder which was universally designated as type "O". Not all holders resembling the type "O" came originally to these exact dimensions, but these were changed to conform to the standard by the manufacturers.

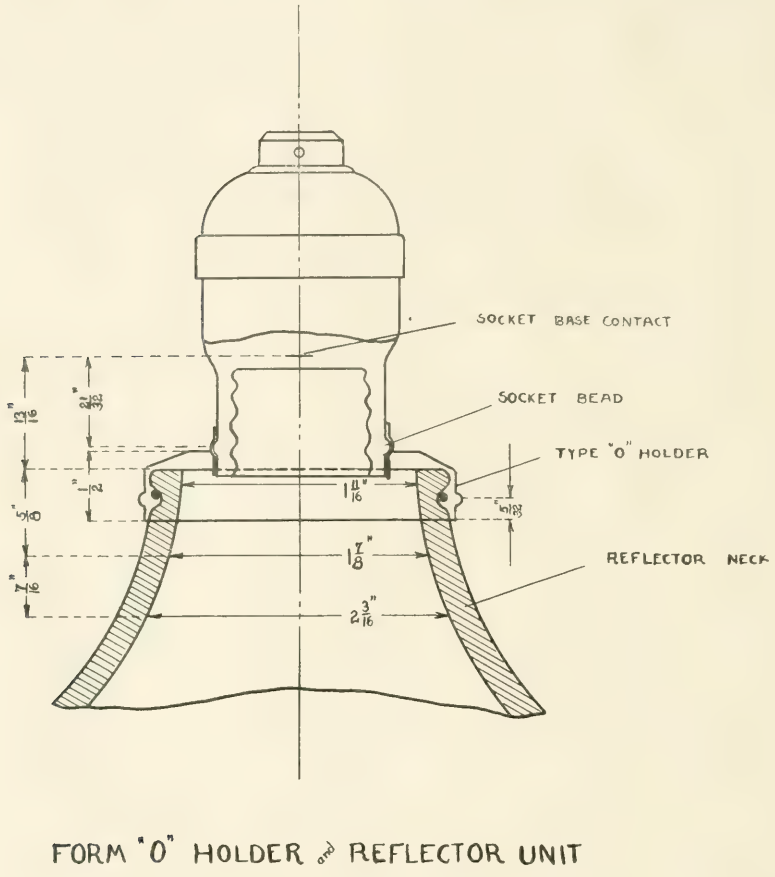


Fig. 4.

The socket manufacturers also made their sockets to conform to our standards, so that the holders, when applied to the sockets, would hold the necks of the reflectors at a certain predetermined position in relation to a common point of reference, namely, the contact point in the socket which supplied current to the end contact of the Edison base. Similar standards were agreed upon for the type "A" and the type "H" holders, as indicated by Figs. 5 and 6.

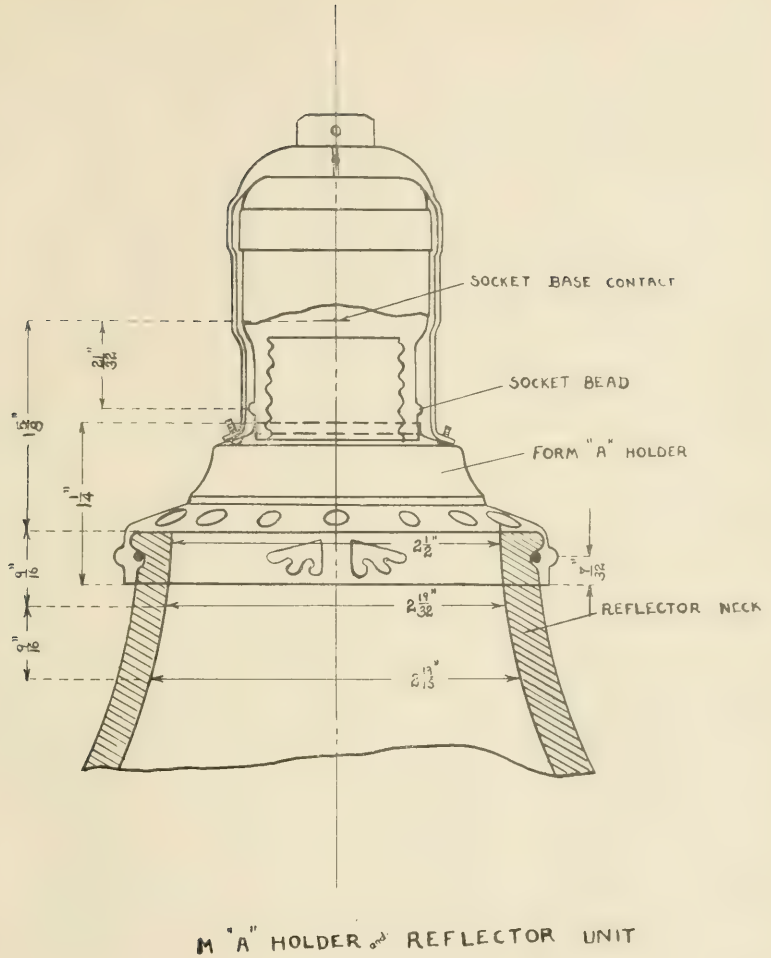


Fig. 5.

The next, Fig. 7, represents lamps of different filament materials, all of approximately 32 candle-power. It will be noticed that with the exception of the large base tungsten filament lamp, the luminous centers of the filaments are at equal distances from the base contacts, the length of the stems supporting the filament varying in the different lamps so as to bring the light center at the proper point. The tungsten filament lamp with the large skirted base has its light center farther from the base contact than the lamp with the small base. In order to use the same type of reflector with both lamps, it is necessary to use the type "O" holder with the short base lamp and the type "H" holder with the skirted base lamp. The difference in the dimensions of these two shade holders is just the right amount to take care of

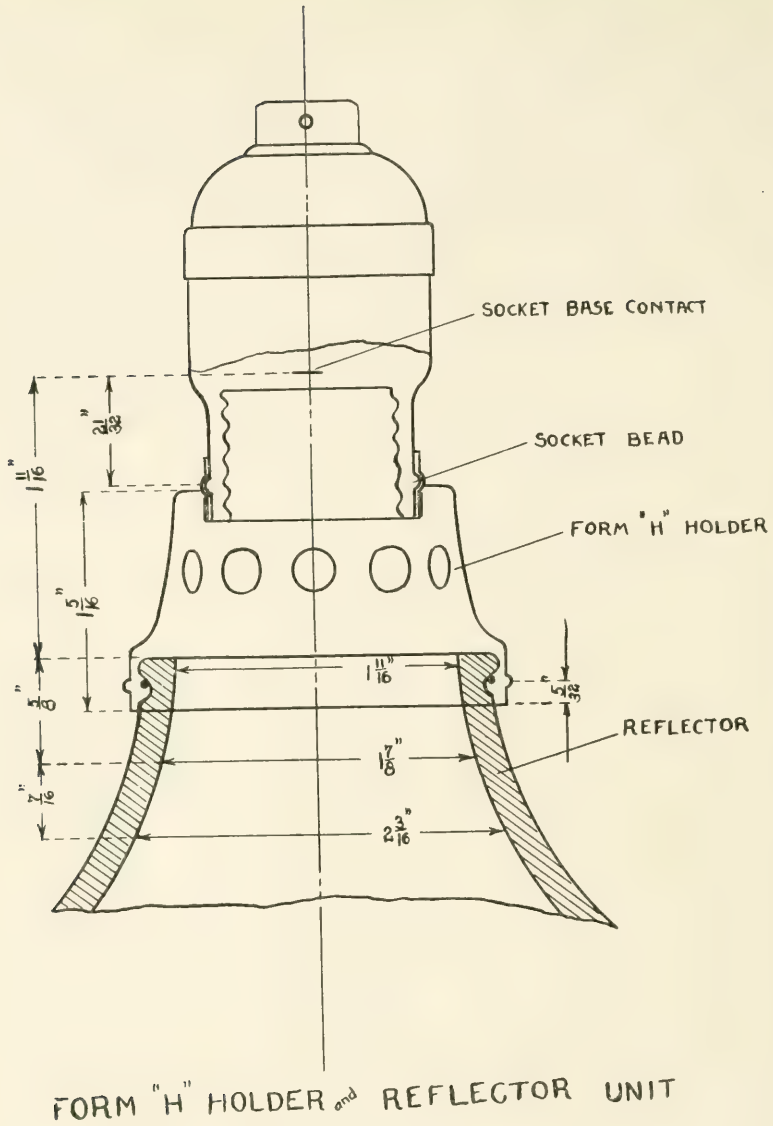


Fig. 6.

the difference in filament location due to substituting a large one for a small one. A very simple rule to bear in mind is that the type "O" holder should be used with all pear-shaped lamps, having a short Edison base, and the type "H" holder with the lamps having long or skirted bases. The type "A" holder is used only with very large lamps.

Many other gauges, of which two types will be shown, were

found necessary to maintain exact standards. The base gauges, shown in Fig. 8, are used to maintain diameter of base, pitch and depth of thread. The bulb gauges shown in figures 9 and 10 consist of sheet metal stampings, made with greatest care to secure uniformity and exact sizes. In connection with the latter, there was much discussion as to how to make gauges with sufficient

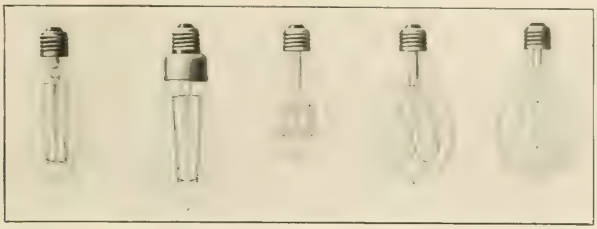


Fig. 7—Lamps of Different Filament Materials of Approximately the Same Candlepower.

accuracy. The problem was solved by the most thorough cooperation between the bulb manufacturers and the manufacturers of incandescent lamps. One man was designated to make these bulb gauges, which were distributed among the manufacturers. It is obvious that no two makers could make two gauges exactly alike. The highest uniformity and accuracy can only be secured

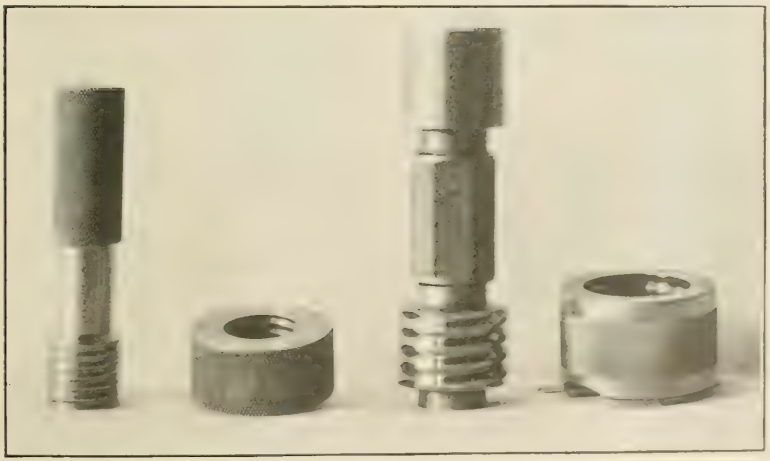


Fig. 8—Base Gauges

by having a single source of construction. The expense of such work was, of course, equitably distributed.

It is obvious that in a paper of this length the matter of standards cannot be gone into in more than an elementary way. The engineers of the lighting industry today are so thoroughly aware of the benefits to themselves and to the community of such

co-operation, that I think we might say we are today passing into the second stage of development where we practice co-operation without being able to foresee the ends to which this co-operation may lead. We thus practice one of the fundamental laws of civilization; that is, co-operation for its own sake. The spirit of co-operation is the spirit of civilization and the highest co-operation must necessarily bring about the greatest civilization and the greatest good to the greatest number. Such co-operation cannot be forced; it necessarily is a growth.

As the child develops ultimately into the highest type of a civilized man in proper surroundings, so, on the other hand,

Fig. 9—Butt Gauges.

might the child have developed into a barbarian had he been without the influence of civilized surroundings to bring him up to the level attained in the past ages, and had he not realized the fundamental truth, that co-operation inevitably reacts to the benefit of the individual and the community.

It is as true of an aggregation of individuals as it is true of the individual; co-operation for its own sake is necessary between engineering bodies in order that civilization may advance. Modern civilization owes much to the engineer. The other professions have contributed greatly to the advancement of the human race, but even in this, the engineer has had his part. The engineer has furnished other professions the tools for progress. The

particular body of engineers of whom I am speaking tonight, have imprinted their decision upon the vast industry aggregating a traffic of many millions of dollars yearly. My observation is that this country is saving many millions of dollars yearly, solely on account of this co-operative action. As civilization becomes more complex, there is more need of the co-operation which has characterized such engineering bodies as ours.

Our national bodies of engineers should be co-related. Their branches should mass together and co-operate; it is the spirit of

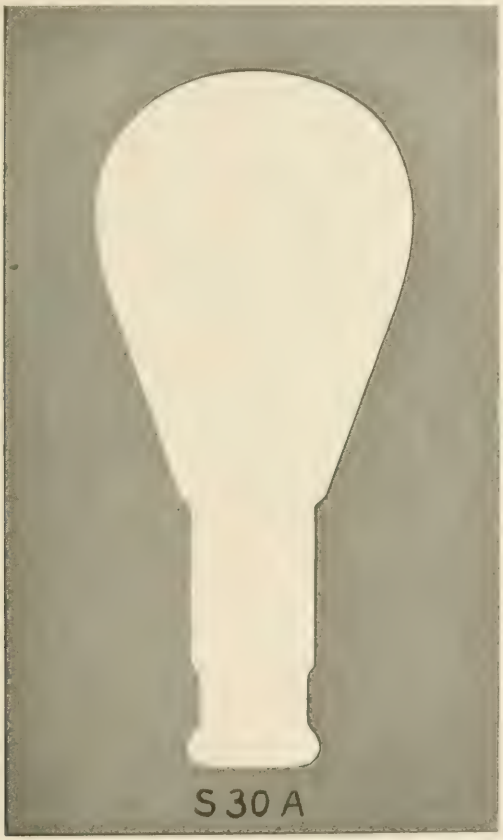


Fig. 10—Pole Gauge

the times. Our children and our children's children will live in a better world, more nearly approximating the ideal as the result of such co-operative effort.

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Memoirs

ALEXANDER E. BROWN

Wherever on this earth, commerce, industry and material advancement are found, whether the place is a great city or some remote outpost of civilization, the name of Alexander E. Brown is known, and his work stands for three distinguished qualities: sincerity and honesty of workmanship; progressiveness; and that intangible spirit which gives life and meaning to every truly great piece of work, whether it be the product of the engineer, the artist, the writer or the manufacturer—that intangible quality of direct, vital, personal interest, the value of which cannot be measured in money.

His death, on April 26, 1911, might truly be spoken of as a world loss. His distinguished service as a leader and pioneer in the field of engineering, invention and design, renders such an expression one of just appreciation only. Yet, such was the modesty and kindliness of his great spirit that those of us who knew him well and met him often at the meetings of this Society and elsewhere, feel most keenly the loss of a friendly and companionable fellow worker.

The study of his career must be an inspiration to every young engineer who reads it. Born in 1852, the son of Fayette Brown, whose name is linked with many Cleveland industries, he was educated in the Cleveland public schools and the Brooklyn Polytechnic Institute, from which he graduated at the age of twenty. Early in his professional experience, he turned his attention with the devotion of an enthusiast to the designing, building and sale of bridges, and in this connection he encountered and studied the problem of the rapid and economical transfer of iron ore. In 1880, he organized the Brown Hoisting & Conveying Ma-

chinery Company, of which he became Vice President and General Manager, his father being the President. The plant of the company was not erected until 1886, but from the earliest time the name "Brown Hoist" was synonymous with industrial integrity.

The first cable machine for handling ore was built by Mr. Brown, and the first bridge tramway for removing ore from vessels to docks. He built the first fast plant for unloading direct from boats to cars. The grab-bucket, man-trolley, the use of electricity for operating machinery for the handling of ore, the blast furnace hoist and top distributor, the first cantilever crane, the car dumping apparatus for loading coal direct from cars into vessels, the self-filling scoop bucket, the pig breaker; with all of these devices, which have contributed incalculably to the material advancement of the world, our fellow member and former President stamped the imprint of his name upon the records of industrial progress.

It has been said of him that he revolutionized the handling of iron and coal; the words are no more than adequate to describe his work. If the products of his brain have stimulated the minds of other inventors and engineers to improve upon his devices, his is no less the credit for the great conception, and he would have been the first to praise the accomplishments of others who followed in the path to which the inspiration of his genius pointed the way.

It is a noble record that he leaves; a name familiarly known not only in the United States, but also in South America and far away India. As we look at his picture hanging on the wall of one of our society rooms, it is pleasant to think of him; to recall his day dreams when he wandered as a boy along the water front, puzzling over the crude machinery of those days; pleasant to think of him as a student determinedly mastering the complexities of his profession; pleasant to think of him as a young man in business winning trade on merit; pleasant to think of him in his maturity, his services acknowledged and recognized and appreciated; most pleasant to all of us to remember how that wonderful mind and that indomitable will were never spoiled for us by pride or jealousy or littleness of any kind; most pleasant to remember his hearty handshake and his engaging smile, his eager interest in all the activities of life, his generosity toward his own profession, the trustworthiness of his friendship, the deep sincerity of his regard.

In this manner the Cleveland Engineering Society places upon its records its affectionate remembrance of Alexander Brown.

Report of Thirty-First Annual Meeting and Banquet

AT

The Cleveland Chamber of Commerce Auditorium

June 13, 1911

Meeting called to order at 8:30 P. M. by President Frazier. Present—121 members and guests.

Reading of minutes dispensed with.

The President called for the names of applicants for admission to membership, and the Secretary read the following names, which on motion, duly seconded, were passed to letter ballot:

For active members:—

JOHN R. CROUSE	THOMAS G. PROTHEROE
FORD DONLEY	GEORGE R. WADSWORTH
HERMAN R. NEFF	EDWARD N. WALTON

The Chairman then read the teller's report, which showed that the entire membership ballot had been elected; and that the following officers had been elected for the coming year:

President, E. P. ROBERTS
Vice President, R. H. FERNALD
Directors, A. J. HIMES and B. R. LEFFLER

The Secretary also read the financial statement for the year ending May 31, 1911.

PRESIDENT FRAZIER:—I believe this finishes the business of the evening. We will now have the first song, which you will find on the slips in your possession.

WE MEET AGAIN TONIGHT

We meet again tonight, boys, with mirth and song,
Let melody flow,
Wherever we go,
We dwell in friendship ever, so true and strong,
And sorrow never know.

CHORUS

We'll laugh and sing, and merry be, tonight,
With never a sorrow near, boys, never a falling tear;
We'll laugh and sing, and merry be tonight,
With never a sorrow near, boys, merry be.
Welcome the time, my boys, we meet again.

Where hand to hand its greeting so kindly gives,
Let melody flow,
Wherever we go,
Where hope is never dying, and friendship lives,
True hearts will ever know.

CHORUS

President Frazier:—Gentlemen, we have a man acting as toastmaster tonight that we all know, an ex-President. I had the pleasure of asking this gentleman to accept the nomination as Vice President, and he said he would take it. I also had the pleasure of requesting him to accept the nomination as President, and he said he would take it. I also had the pleasure of asking him to serve as toastmaster tonight and he accepted without complaint. In fact, I don't believe anybody ever asked this gentleman to do anything and received "No" for an answer.

A story goes that during the beginning of his career, he, like all other engineers, had to look out for a job. He thought he would like to get into the railroad business and called at the superintendent's office of a certain railroad company. He asked if he could see the superintendent. They said he could. He was ushered into the room and the superintendent asked him his name. He replied, "Beahan." "What do you want?" "I am seeking a position, have you any vacancy?" "What can you do?" "I am an engineer." "An engineer—why, I have a job I can give you right off the reel. Just come with me." They left the office and walked down the track, past one building and another, and finally came to a locomotive standing on a track. "Now," said the superintendent, "you say you are an engineer. You see that locomotive and roundhouse? I want you to run that engine into the roundhouse."

Poor Beahan was so thunderstruck that he didn't know exactly what to say. His nerve was with him, however. He mounted the cab and in his usual dignified way looked over the different levers and said, "All right, sir, I will run her in." He put his hand on the throttle, it opened, the engine started to move and went into the roundhouse, but to his surprise, the thing didn't stop, and when he found that he was going to run into the other end of the building, he thought there would be something disastrous, and he reversed the lever and shot out into the yard again. He went through the same performance outside, and shot back into the roundhouse again and then back into the yard. He kept on switching back and forth, and after doing it several times, there being no fireman on the engine, the engine died and came to a rest at the same place where Mr. Beahan had mounted the locomotive. The enraged superintendent said, "I thought you said you were an engineer; why didn't you put that engine into the roundhouse?" "Confound you," said Beahan, "I had it in three times. Why in the devil didn't you shut the door?"

Gentlemen, I have the pleasure of introducing Mr. Beahan.

Mr. Willard Beahan:—Mr. President and gentlemen of the Society, that is an excellent story and a true story. Some of you will remember that I told it here some years ago myself. But as a swan song for a president, I submit that these remarks we have listened to beat anything that the singing table has done here tonight. I didn't expect to be introduced, and it has thrown me somewhat off my bearings. I think a little explanation is needed, why a past President was put up as toastmaster, it being

most undignified. In my earlier years, when I had time to study and read some, before I got to being toastmaster and making after-dinner speeches, I came across this little incident in the history of the human family. In those good old days, when warfare was carried on as between man and man, a hand to hand contest, the strength of one man sometimes seemed to be quite necessary. As the little wars went on between little tribes and little communities, if the man was a very good man, he would be sent for to help out; and a little couplet which I remember from my boyhood reading, praising one of those good men, ran something like this:

"When they wanted a man to put out in the van,
They sent for Herman Von Sprechen."

Now, the Cleveland Engineering Society, in its battles frequently needs a man to put out in the van, but we don't send away for him; we have another and a better way within our own walls. As you enter our club rooms upstairs, you will notice—to the left of a door—a little room, the office of the President. But the walls of that room are the catacombs of this Society, and in the fronts of the various sarcophagi are resemblances or facsimiles of those noted men who are past Presidents of this association—a very charming custom. When a man is past President, he can see how he used to look when he was young and handsome. When we need a man to put out in the van, we go down to the catacombs and pick out some man that we think will do as chairman of some committee, or to be sent to Pittsburg to bring the Mechanical Engineers here, or to represent us at Washington, or to put on some Chamber of Commerce committee, and we draw one of those past Presidents out of his sarcophagus and put life in him again. There is where we got our past President toastmaster tonight. The real workers were growing a little tired, and we had to go back into ancient history and drag out a man with the whitest beard there, but not quite so gray as he might be, for various reasons, and make him toastmaster. Now, the ladies say that you can make almost anything out of a man if you catch him young enough. That is their experience. In my case, I was caught very young—as a President. I believe I was the only man in this association that was elected President in the third year of his membership. I am very grateful to you for it. But that being the fact, as I was elected the youngest, and we never progress after we get our pictures on the wall, I therefore expect to be *eternally* the youngest past President of this association. I am liable to be toastmaster or to do any little stunt that is too festive for the President or too unseemly for the average past President. So, tonight, I occupy this position to help out the President, who is worn, as you see, who is tongue-tied, as you have already observed—and I have to come to his rescue. (Laughter.)

These meetings are always pleasant, even if the toastmaster's duties be somewhat uncertainly performed.

We have all heard of Chicago, that great western metropolis

of our nation; and of Chicago we are most proud. Some of us even think that Chicago is America, some of us who have lived west of here for a distance. Others really believe that America is Chicago. While I was in that great city the other day, a personal friend of mine told me this incident; the fact that it is true doesn't make the story any better, in fact I think it mars it a little, because it ties me down. A general passenger agent told me this incident, which happened the other day at the very beautiful Northwestern Ry. station, just opened there. The first day the crowd was gathering, and the trains were running, the newspaper men thought they espied a man from whom they could get some copy. He was a Swede very plainly, by his dress and his baggage, his little knapsack and his stick and the bandanna carrying his lunch, and the red cheeks and tawny beard of the Scandinavian, that great race that is helping us so much in the northwest. So he hailed him, "Ole, you just coming to America?" "No." "You are just leaving America?" "No." "Well, how long have you been in Chicago?" "Don't know, three days, I suppose." "How do you like it?" "Don't like Chicago, don't like America, to hell with America!" "What is the trouble?" "Well, no suit me." "What other countries have you been to? Where are you going?" "Been in two foreign countries. Going back to them." "Well, where was that?" You see, the reporter was getting somewhat mixed, he didn't know which way the man was headed, or very much about it. "Where am I going? I am going back to the two foreign countries, where I came from, Minneapolis and Minnesota."

You see, Chicago and America meant the same to this poor fellow, and so it does to many of us.

But Chicago was at one time not so great as it is today. They say there was a time when—in the language of that story you have heard, when some one said to Columbus, "Columbus, why did you discover America?" And Columbus went on to tell how he made up his mind to discover it, and went and did so—somebody said to the President of the B. & O. Railroad, many years ago, "Garrett, why don't you discover Chicago?" And he said, "All right, we will discover Chicago." So they called upon one of their young men, well adapted to wading streams and exploring marshes, and said, "Isham, you go and discover Chicago." It wasn't long after, that this young man went out and discovered Chicago, built the B. & O. Railroad to that city and stayed there. Chicago needed him, this mud-flat village in a marsh, a most unpromising place in a way—some might think they needed a wet-nurse to get rid of its wetness. You couldn't build Chicago in the usual way, it needed an unusual man to build it. Ordinarily here in Cleveland we dig down to the rock and put up the wall. Not so in Chicago—it would float with the rise and fall of the wind, just as Toledo does yet. You might put it on piling, but the giants of the forest don't grow tall enough to get down to the rock of Chicago. Somebody says, "Splice them," but there comes in the legal brother. In those days you couldn't "splice" anybody or anything under Illinois

law so it would stay spliced. So he had to build the city on mud barges all around and get its depth of flotation, put up a building and figure it would go down 2 or 3 feet or go below the sidewalk. So he had to figure better the next time and worry over it, and wade around in the mud in the meantime. The city grew, the effluvium grew, the river was catching fire and the stuff was floating out on it, and there was trouble. So this man looked into the matter and discovered what was wrong. The Creator's work had been interfered with. Lake Michigan was running to the north and east when Jehovah intended it to go west. What had happened? Some revolutionist or volunteer in reform had been interfering with creation and tipping up the crust of the earth until the water ran in the wrong direction. So he said to them, "We have got to correct things, put things back where they were, build a drainage canal and make the city fit to live in."

That is the way things have been going in Chicago, and this man is here tonight to tell us of his line of work, the man who has done so much for Chicago; an engineer, and more than that—a man, an honest man, a man needed in the drainage work. First, before we have an engineer, we must have a man, and character counts first. This is not his only work, possibly not his greatest work, not the work of most national importance, but I have no doubt it is the work he loves most and the work to which he has given the most of his life. And I take great pleasure in introducing to you tonight our great brother engineer, our grand citizen of the metropolis of the west, who will speak to us on "River and Harbor Improvements", Mr. Isham Randolph. (Applause.)

(Note.—For Mr. Randolph's address see page 5, this issue.)

The Toastmaster:—Gentlemen, I want to commend that after-dinner speech. There was something to it, and it didn't take all night. He gave the citizens of this great town of ours something to think of, and I am sure we will take these valuable suggestions home with us.

Now we will sing No. 2, and we will sing it in a way we didn't sing before.

ENGINEERS ONWARD

(Air—We Rally Round the Flag)

We have gathered at this banquet
From the East and from the West;
Shouting the battle cry of Onward!
We are men of nerve and action,
And of brains the very best;
Shouting the battle cry of Onward!

Chorus

Engineers ever! Hurrah, boys, Hurrah!
Of everything clever, Hurrah, boys, Hurrah!
It is hard to find the peers
Of the brainy engineers,
Shouting the battle cry of Onward!

We can dam the greatest river,
And can turn its course at will;
Shouting the battle cry of Onward!
We can make the mountains quiver,
And build any kind of mill;
Shouting the battle cry of Onward!

With great bands of steel and cable,
We have girdled earth and sea;
Shouting the battle cry of Onward!
And with these we have been able
To make time and darkness flee;
Shouting the battle cry of Onward!

We can build a ship of battle,
Of ten thousand tons of weight;
Shouting the battle cry of Onward!
We can make the nations rattle,
And can help decide their fate;
Shouting the battle cry of Onward!

We can tunnel 'neath the ocean,
And can build a ship canal;
Shouting the battle cry of Onward!
Where there's any great commotion
You'll find engineers "et al.";
Shouting the battle cry of Onward!

We have harnessed up the lightning,
Through the air we fly in cars;
Shouting the battle cry of Onward!
Soon we'll be new worlds a-brightening,
For we're sailing toward the stars;
Shouting the battle cry of Onward!

THE TOASTMASTER:—Not only do we have our physical problem today, of which we have heard tonight, but our moral and our social problems as well.

This is the great age of the reversion from graft. I question if there are not a great many well-meaning men who have a very blind conception of what graft really is. There is a story I heard the other day of an excellent German out in Iowa, a farmer there, who died but a short time ago. He went there when the country was new, and, of course, he had his hard times. His land lay a little low and if there happened to be a wet season, he didn't get very much grain, and he was troubled along towards spring to find grain to feed his stock. But one day, as he passed by the granary of his neighbor, whose land lay higher, he spied a knothole, and this thrifty Dutchman thought he saw a way out of his difficulty. The knothole was covered on the inside with a few husks of corn only, and he moved them aside temporarily, drew out the grain he needed, closed the knothole and went on. During the rest of the season he drew on his neighbor's grain through the knothole. The next year, a little worse luck happened, again he resorted to the knothole. To make a long story short, for the next 40 years he led what his conscience told him was an honorable life, he raised a family, was a reputable citizen, became prosperous to a considerable degree. They didn't send him to the legislature, because they thought he was too honest a man, and recently, after a long and reputable life, he

wrote his will thus: After bequeathing all his real property, he wrote this codicil with his own hand, a few days before he died: "I do devise and bequeath to my most beloved son, John, my most valued property, the knothole." The good man had come to think that it really belonged to him. That is the moral of the story. I can remember men, 40 years ago, who fell into certain business practices that many other men fell into at that time, who have kept them up to this present time, practices which we call graft today, but which they didn't call by nearly so harsh a name then.

We should be punished for what we do that is wrong in this world; we know that we will be punished by a just and wise Judge hereafter. But it is a little harsh to arraign our grandfathers before a jury of their grandsons and judge them today for acts which they committed a half century ago. Still this is graft, and where shall we draw the line? We have to draw it. Such organizations as the Chamber of Commerce have that duty delegated to them today in many cities, and in no city more than Cleveland. We have a Chamber of Commerce here, Mr. Randolph, which is second to none in its widespread activity, in its thoroughness, in its uprightness, in its good repute and in its standing among our citizens. We used to say that when we wished a thing done, we should go and do it ourselves. Cleveland don't do that; when she wishes a thing done, she turns it over to the Chamber of Commerce, or rather, looks toward the Chamber of Commerce and the Chamber does it—we don't have to turn it over.

We have with us tonight the Field Marshal of the Chamber of Commerce. Some men are leaders. Some men are wheel horses. Still others are four-horse teams. I take great pleasure in introducing to you our honored citizen, Mr. Charles E. Adams, President of the Chamber of Commerce, who will now address you. (Applause.)

Mr. Adams:—Mr. Toastmaster and gentlemen, I thought while the toastmaster was telling that story that I wished I could find a knothole to crawl into and get out of this, because when your worthy President asked me if I would come here tonight and represent the Chamber of Commerce and say a few words, and asked me what I would speak about, I told him I would let him know. And then the Secretary, when he wanted to get up this program, wanted to know what my subject was, and I still had no subject, because I am like one of the characters in that very old and ancient story of the two Irishmen who got up in a hayloft to sleep one night. The barn caught fire; they were at a loss to know what to do, but finally decided that one should jump out first, and if he landed all right, the other would follow. Pat jumped out and Mike stayed up. After giving his companion a reasonable time to get down, Mike called out, "Pat, are you killed?" "No, bejabbers," replied Pat, "I am not killed, but I am spacheless." That is about my situation tonight. I am not killed, but I am not a speechmaker.

I wasn't going to make any speech to the Cleveland Engineering Society, because I didn't know what to talk about. Certainly I couldn't talk anything about engineering. The minute I would get on that I would be a good deal like a little Jew, about whom I heard a story the other night that struck me as being pretty good. Mr. Einstein and his wife and little son went to the seashore. Einstein was about as tall as Mr. Randolph here, his wife not quite as tall, and little Jakey about up to the top of this table. The first day they went to take a bath, Einstein took Jakey by the hand and waded out until he was up to his neck, and his wife, away back, holloed and said, "Isaac, Isaac, what has become of little Jakey?" And Isaac holloed back, "Oh, Rebecca, Jakey is all right, I have him by the hand." (Laughter.) And I thought if I started in, talking engineering business, I would be about as far over my head as little Jakey was, so I wasn't going to say anything about that.

I have a great deal of respect for you gentlemen who are engineers. The first few years of my business life I didn't pay very much attention to you, it didn't seem as though we needed any of you. Then one day we thought we would arrange to drive our factory with electric power, and I thought the proper way to buy that electric power was to go out into the market and buy it like anything else. So I wrote around to every electrical concern in the United States that I knew anything about and told them we wanted to equip our plant with electric power and wanted their lowest price for it. They came around one by one and talked with us about amperes and kilowatts and one-phase and two-phase, and I sat there and looked wise, getting worse and worse confused all the time. By the time I had been at it a little while, I didn't know where I was. So I went to a friend and said, "I am over my head here, I don't know what these men have been talking about, and they have got me nearly crazy. What am I going to do?" And he said, "You want to go to an engineer and let him put in your plant." So he told me somebody to go to and I went there. Of course, the electricians told me that I had made the mistake of my life then; they said that was the most foolish thing I ever did, because, they said, "Of course, this engineering concern you have picked out uses only one system, and they don't care whether it is right or wrong." But I have burned all my bridges and started with these people, and I have stayed with them.

And I made up my mind that there is something to the engineering business, and that it means something. I have been thinking about your work for the last few days, and it seems to me that it is a good deal like the prophet's work, you have to look ahead and see all these things long before they are done. You men have to have a vision, you have a thing in your brains and on paper, and you have to do all that hard work which has to be done, all the thinking out, and then the contractors come along and complete this great work, whatever it may be, that you have planned. And it seems to me a wonderful business that it

takes a wonderful mind to do, a wonderful education, and I stand here with awe and respect for men of your profession.

And then I am thinking what you might do as engineers and as this Cleveland Engineering Society, for your city and for your state, because, gentlemen, I believe that we owe something to our home and we owe something to our city, and I am talking now to you gentlemen individually, because I understand that I am now looking in the faces of the Cleveland Engineering Society, and that this Cleveland Engineering Society is not its officers, but it is all you men, and as I look into your faces tonight and realize what there is ahead of this city, because I have some idea of the great problems that are before the city—I know very little about river and harbor work, or about the lake front work, except as I hear it in the Chamber of Commerce work—I know what great works these men who do know say we need here and must have in the future, I know what enormous problems they say we have before us, and I know they know what they are talking about. And I know that this city is going to need you men and to need this organization, and to need the advice and the work that you gentlemen can give it and should give it, and I believe, will give it. City administrations may come and city administrations may go, but these great problems of building up a city, of which Mr. Randolph has spoken tonight, require us to look twenty-five and fifty and a hundred years in the future. You and I will be held responsible in the future for the mistakes and the negligence of today. And so I believe that it is up to just such organizations as this, not only to come here and come to your meeting and entertain each other, not only to come to these meetings and get what you can for yourselves, and I am sure, at your meetings you do get great good, but I believe that you have a responsibility towards your city and towards your state. We have a great growing city here. We are talking about a million people and we are looking forward and making plans for a city of a million, and I suppose when we get the million we will still be looking for more—we will, if our ambitions are right. And the problem of giving that million people a livelihood, and the problem of keeping this city so that it can produce and can furnish employment and furnish homes to those people and to do that in an intelligent way, is going to devolve upon just such men as I see sitting before me tonight. And so, gentlemen, I believe that this organization has a great responsibility, just as I believe the Cleveland Chamber of Commerce has.

We in the Chamber of Commerce are attempting to do what the toastmaster says—we are attempting to do the things that we believe will be good for our city, and we believe that we can be helped by you men in an organization of this kind. And so I come to you tonight, pledging you our co-operation in undertaking these great engineering problems, in giving assistance and advice to the city officials and the county officials, and to those people who will have charge of these great engineering problems in our city to a very great extent, because I don't think

it is necessary for us to discuss private affairs; there is enough in the great public affairs in this city before us for the next ten or fifteen or twenty years, and, as I said before, I am pleased to come here tonight and pledge the co-operation with you of the Cleveland Chamber of Commerce in any work we may find it wise to undertake. (Applause.)

THE TOASTMASTER:—It is written in a book which, I am sure, we all read, that "your young men shall dream dreams and your old men shall see visions." But you see, there are some exceptions to that, because some men see visions before they are old, as Mr. Adams has shown us tonight. He sees the vision of Cleveland; that is why he is a fit President for its Chamber of Commerce. And I wish to say for his information and for the information of our younger members, that the reason we are now tenants in the Chamber of Commerce building as the Cleveland Engineering Society, is because we felt, less than a year ago, that by being here we could be more accessible to you and be able to help you and to help our city. A short time before that we had changed our policy, we had resolved that we would come out of our shell and not only do our work as citizens of Cleveland, but as engineering citizens of Cleveland, and we are here for that purpose.

HEIDELBERG

Better than riches of worldly wealth
Is a heart that is always jolly,
Beaming with happiness, hope and health,
And warmed by love divine.
But sweeter than kisses we win by stealth,
Are the hours we give to folly,
So come, let us clink,
But first let us drink
One toast with the brimming stein.

REFRAIN

Here's to the land which gave me birth,
Here's to the flag she flies;
Here's to her sons—the best on earth,
Here's to her smiling skies;
Here's to the heart which beats for me,
True as the stars above;
Here's to the day when mine she'll be,
Here's to the girl I love.

Heidelberg, dear Heidelberg,
Thy sons will ne'er forget
That golden haze of student days
Is round about us yet.
Those days of yore
Will come no more,
But, through our manly years,
The thought of you
So good, so true,
Will fill our eyes with tears.

Mr. Randolph:—Gentlemen, the Toastmaster has permitted me to tell you a story. Speaking of graft reminded me of this. Our Sanitary Canal was opened in 1900. During the winter session of Congress, there were a number of Chicagoans in Washington, and they gave a dinner to some of the distinguished members of Congress and the Senate, and I was asked to describe this work. Just before I spoke, Uncle Joe Cannon made a brief speech, in which he spoke of this work, and he wound up by saying, "And, my friends, these thirty-three million dollars have been expended without one breath of scandal." He sat down, and Amos Cummings, of New York, got up and said: "Gentlemen, I have watched this work from its inception, I have followed it straight through. I have listened with intense interest to what the mentor of the House from Illinois has said. But his last remark astounded me. Thirty-three million dollars expended without a breath of scandal! We don't do things that way in the state of New York. In our state a Republican legislature appropriated nine million dollars to deepen the Erie Canal. A later Republican legislature appointed a committee to find out what had become of that money. They found that three million dollars had gone to the Erie Canal and six million dollars had gone somewhere else. If the Democrats had been in power, it wouldn't have happened that way; if Tammany had spent all that money, it never would have happened that way—at least if it had, a Democratic legislature never would have found it out." (Laughter and applause.)

The Toastmaster:—The serious part of this program is now approaching. There will be something said by the next speaker that will surprise us. We have been doing things this last year, a great many things. We have had a man at our head who has been very active—many of you here can testify to that fact. He has built up this organization by high means. I suppose there is hardly an engineer in Cleveland who has not been visited by this man—you have all been given a chance, whether it was in your line or not. Perhaps we need to apologize to some one here tonight, who has been approached too vigorously to join this great and glorious organization. Indeed this official is in much the same situation as the dentist in pulling a tooth. After it was out, the fellow said to him, "You pulled the wrong tooth." The dentist said, "Is that so? From the way you hollored, I thought I had pulled the right one. But no matter, I will pull the other one now."

But we have invited anybody and everybody, an entirely open shop, we have been very active in this matter, and this man is the mainspring of this activity. In fact, it is really the custom of this Association to have our President preside at the banquet as Toastmaster. It is a proper custom. But when the time came for the annual banquet, we discovered a condition and not a theory confronting us. This man had talked membership so much that his tongue was worn to a stump, and he could only give us a stump speech tonight, and that the committee wouldn't

like. We are going to have him confine his oratory to abstracts and committee reports.

We have done more work, I think I am safe to say, in this year toward our upgrowth than in any of the previous years of the Association's history. This is due to our President. I cast no animadversion upon the administration of any previous President in saying that, but I think I may be allowed to make this remark, that he has been the most active and efficient President this Association has ever had. We give him the full credit for it. (Applause.)

Now, of course, he will rest. He will pass into the mausoleum, upstairs. We welcome him with outstretched arms. It is pleasant to be a has-been, even though you arouse the enmity of those who never were. Just think that over and see what is in it. Just because we past Presidents throw rocks at each other, don't think we are the worst fellows in the world. We are up high and don't hit anybody but ourselves on account of the altitude, so it is perfectly proper and right for one past President to jolly another. So when we get to the highest pinnacle in this Association—we can't be a President but once—we are cognizant of that little expression, "There's a divinity that shapes our ends rough, hew them as we may." (Applause.)

PRESIDENT FRAZIER:—Mr. Toastmaster and gentlemen of the Engineering Society, and guests: It was not the request of your retiring President, now ex-President, to be placed on the program tonight. He would much prefer to partake of the banquet and listen to others talk. But we have certain rules and laws of this organization that must be observed. One of the rules, I am sorry to say, is that the retiring President must make an annual address.

I find myself this evening very much like the lady who left New York for Brooklyn. When she came to the Brooklyn bridge, she was stopped by the attendant and asked, "Madam, do you want to go to Brooklyn?" "Heavens, no! I don't want to, I have to."

The subject that I have this evening is "A Review of the Past Year's Work". It would be impossible, or at least it is for me, to give this review and the statistics that will be required, without a manuscript, so with your kind indulgence, I will read what I have to say.

The Executive Board.

The Executive Board organized by electing Mr. F. W. Ballard, Secretary; Mr. E. E. Ranney, Treasurer, and Mr. G. H. Tinker, Librarian. They authorized the Secretary to secure the services of a capable man to act as Assistant Secretary, who would devote his entire time to the work. This position was tendered to and accepted by Mr. G. S. Black, and the manner in

which the work has been handled by him has been so satisfactory that we do not know how we ever got along without him.

The Board instructed the House Committee to secure new and more desirable quarters. It approved the appointment by the President of standing committees and authorized him to appoint various committees on civic affairs and authorized the Secretary to secure a suitable Society pin, which we are pleased to note is now being worn by several members.

It authorized the President, Secretary and Treasurer to act as a Committee to co-operate with the local members of the American Society of Mechanical Engineers, in an effort to secure the convention of that Society for Cleveland in 1912. It might not be out of place to say here that through the efforts of this committee, in conjunction with the Convention Board of the Chamber of Commerce and the local members of the A. S. M. E., the convention will be held in Cleveland, in 1912.

The Board also transacted the usual business of the Society and looked after its affairs, holding twenty-two meetings.

The Finance Committee.

The Finance Committee, under the leadership of your new President, Mr. E. P. Roberts, has faithfully looked after the financial interests of the Society; has installed a new order and voucher system which is not only a great convenience to the Finance Committee, but also furnishes a complete record of all orders from time same are placed until the account is paid.

The Library Committee.

The Library Committee, under the faithful leadership of Mr. G. H. Tinker, who is a whole committee in himself, and who has rendered such efficient service for a number of years to this part of the work that one can hardly speak of the Library without thinking of Mr. Tinker, was required to do an endless amount of work in transferring our library from our old quarters to the new, and the efficient manner in which this was performed is sufficient evidence that the committee has been working.

Our list of periodicals has been more than doubled during the past year, and several valuable volumes have been added to the Library. We are very much indebted to the estate of the late Albert H. Porter for the valuable collection of books which were donated to this Society from his Library.

Publication Committee.

The Publication Committee, under the leadership of Mr. G. F. Burrows, has certainly made our JOURNAL a success the past year. A few years ago we were paying out several hundred dollars annually for the publication of the JOURNAL. During the past two years we have added advertising pages and the income from this source makes the JOURNAL nearly self-supporting.

Program Committee.

The Program Committee, under the leadership of E. H. Owen, has faithfully looked after the work assigned to this Committee. They arranged for 16 regular and special meetings, at which there was an average attendance of 105. Very interesting and instructive papers were presented, which not only made the meetings extremely interesting, but also were a source of valuable material for the JOURNAL.

The one-day outing at Erie, under the management of this Committee was indeed an enjoyable affair.

The Committee also looked after the entertainment of the Detroit Engineering Society, when it visited Cleveland last fall, as guests of our Society, and although a disagreeable day, the well-planned program was enjoyed by all. Our visit to Detroit two years ago and the return visit of the Detroit Society to this city, has brought the two Societies in close touch, and it is generally understood that a joint outing of the two organizations will be planned for this summer or fall.

Membership Committee.

The Membership Committee, under the leadership of Mr. David Gaehr, has done more work than any similar committee at any time in the past history of the Society. A year ago we had a membership of 310. The present Membership Committee, with the assistance of various members of the Society, have presented to the Board 190 new names; this, added to last year's 310, would make a total membership of 500.

During the past year the membership has been decreased by six deaths, 24 have resigned—largely due to removal from the city—and in addition, eight were dropped for non-payment of dues, leaving a net membership of 462. The membership was increased something over 60 per cent, which is certainly a good year's work.

At the beginning of the year an urgent request was made that each member of the Society endeavor to secure one new name. In order to show what percentage of the membership has actually been securing new members, a list has been made up which shows that one man secured 23 new names, one 18, one 12, one 11, two 9, one 8, one 7, one 6, three 5, one 4, four 3, thirteen 2, and thirty 1; or sixty men secured a total increase in membership of 190. Of this 60, about 50 were members last year, or 16 per cent of last year's members did all the work of securing this increase. What would have been our enrollment if all had done as requested, secured at least one new member, and it is to be hoped that a greater percentage will take more active interest this coming year in the building up of the organization, for in number there is strength.

House Committee.

The House Committee, under the leadership of our Secretary, Mr. F. W. Ballard, has, we all know, done faithful work during the past year. The Executive Board assigned them no

easy task when it asked them to secure new quarters, and our removal to the Chamber of Commerce building, where we are centrally located, has certainly been the means of bringing in no few new members and giving a place more accessible to all. Mr. Ballard, not alone in his work as Chairman of the House Committee, but in all his duties as Secretary, has performed faithful service for the Society, and we should be congratulated in having him to look after our affairs as Secretary.

In his address last year, the speaker said that he would be pleased to see the Society take more interest in Civic affairs, especially those relating to engineering problems. The matter was brought before the Executive Board, and as previously stated, they authorized the appointment of various committees on Civic affairs. With this in view, a River and Harbor Committee was appointed, with Mr. Willard Beahan as Chairman. This Committee held several meetings and conferred with Col. Millis, United States Government Engineer of this District, Ex-Congressman Cassidy, as well as with the City Government officials, on various matters relating to the outer and inner harbor improvements, and we are pleased to say that much interest was shown by the members of the Committee on the work assigned them.

The Bridge Committee, of which our Ex-President, Mr. C. H. Wright, is Chairman, likewise held several meetings, at which various public improvements were discussed, notably the new high level bridge and the Grade Crossing elimination.

The Building Code Committee was not organized until recently, but I believe has had two meetings, and now has under consideration the revision of the city building code.

An invitation was extended by the President of the Chamber of Commerce to this Society to appoint three of its members, who were also members of the Chamber, to serve on the Municipal Art and Architecture Committee of the Chamber. Mr. Osborn, Mr. Fernald and the speaker were appointed by the Executive Board as representatives from this organization. We are certainly indebted to the Chamber for the opportunity to serve, for we feel there is a great field of work for such a committee, and we are more than pleased, as engineers, to be associated with the Chamber on this work.

The President received a request from Director Hogen that we appoint two men to represent the Society on a Commission to investigate the collapse of the Henke building. Mr. Leiler and Mr. Henderer were assigned this work and they, with two gentlemen from the Builders' Exchange, and two architects formed the Commission. A painstaking investigation was made and a voluminous report prepared, which received commendation from all sources.

Now, gentlemen, the Society has only started on its work of civic affairs, and it is to be hoped that as questions arise, that are pure engineering and of public interest, that this organization will be foremost in its efforts to be of public service. Do not let us for a moment think that we are organized for the benefit only of

those within, but let us take a broader view and see what good we can do in building up the city, of which we are all so proud.

In closing, let me repeat the definition of an engineer, given by Mr. Tredgold, of England, in 1827: "Engineering is the art of directing the great sources of power in nature for the use and convenience of man."

There is much to be done here in Cleveland "for the use and convenience of man", and therefore must be done by engineers. Let us join with other public organizations and do our share of the work that must be done to make our city second to none.

(Applause and singing, "For He's a Jolly Good Fellow.")

THE TOASTMASTER:—That is a most gratifying report. We are in splendid condition. This is high-water mark for this Society, up to tonight. Now comes the next year, and we will see how much we can beat it.

There are times when even I feel a little puzzled what to say—I know there are some young men here tonight who would find it hard to believe that, but it is true. A little incident that occurred some years ago at Castle Garden, when we used to land there instead of at Ellis Island, is suggested to me. A rollicking young fellow from the old sod came running up the gang plank. "How are you?" "I am feeling fine, but I had a very rough passage. I nearly lost all my baggage." "How did that happen?" "The cork came out." Something like that is liable to happen now.

Some men ought to be born twins—there isn't enough of them. The nearest we have to a twin of the next speaker is Frank Osborn. He isn't here. He is pretty good, good rather than pretty, but these two men always enliven things in our Association and we are most thankful to dance for them. Some men have been professors and are professors of one thing and another. It is very rare that a man is at one time in his life known as professor of electrical science and then later in life known as professor of nonsense; that happens to few of us, but now and then, there is such a rare spirit. When we catch one, we love him, for the reason that Artemus Ward loved the little kangaroo, because he was "an amoosin' little cuss."

Now, our President-elect can be spoken of in this deprecating, light-hearted way, but still we don't think of him in that way. We know that we are going to have a work year before us. We know that this man will block work out for us. We expect he will do it on some original lines and original ways peculiar to E. P. R. But we know him to be an engineer, and a good fellow. The song you sang cuts both ways, forward and back, and it hits a good fellow in each direction. Some men are born great, some achieve greatness, while others have greatness thrust upon them—by being elected President of the Cleveland Engineering Society. I take great pleasure in introducing Mr. E. P. Roberts. (Applause.)

Mr. Roberts:—Mr. Toastmaster and gentlemen: Before any statistics of what has not happened, I merely want to make a few comments. We have heard our toastmaster tonight; he is a battle-scarred veteran—some of us are just as old, but we have the ability not to show our scars in the same way. It is like a statement, made not long ago at a dinner, where a lady was in an extreme dinner dress, and a gentleman looked at her and said, "Well, I was operated upon for appendicitis, too, but I don't show the scar." It is the same thing here. (Laughter.)

Now, today at lunch Mr. Randolph gave a very short talk about river and harbor improvements, and he said something to this effect, that the city should be always at least one lap ahead. If it needed two piers, it should have three. That was taken right to heart by Mr. Frazier. After taking a trip in a tug, he rushed off to get his dinner suit. He was standing in one of our crowded cars, and the car gave a lurch, and he went ahead and sat down in a lady's lap. He went a lap ahead—took it right to heart the very first thing.

I also want to call attention, while I am dealing with personalities, to the fact that we have an ex-President with us tonight, Mr. Henderer, but I am not sure that it is quite proper, the way that company, of which he is the head, is acting. We are pleased to be very business-like in our efforts, and I claim he is making a grandstand play. We needed a grandstand here. They built it. One burns down in Washington, and they go down and build it, and another in New York. I understand it has been said that they have employed a great detective, named Burns.

Another President, pretty near an ex-President, has made an apology for reading his remarks, and he had a fairly good excuse, and I have been wondering what excuse to make for reading mine. It is hard to get an excuse except laziness. The only thing I could think of was to lay it to my associate My associate, Mr. Abbott, has been away several months and has been back several days and has kept me jumping all the while. There is something in this that may be worth while, and if I didn't read it, I might miss something of interest.

Gentlemen:—

It is now your painful privilege to appear to listen to your new president. You have brought it on yourself, but, as a matter of principle, why should the incoming president take up *an hour* or *two* of your time? He has not done anything, or anybody, except the nominating committee. He can turn out more or less rounded, or flat, periods, revolving around himself as a center, but with no motion of translation (if such a motion were made, it would not last for a "second"). Nothing gets anywhere, unless perhaps, either the "wobble" or the "eccentricity" is so great that a piece or two flies off and hits somebody, somewhere.

What I will say will be a very useful argument against the incoming President making a speech, and I commend it to any insurgents.

Appreciating your position, I have decided to omit one-quarter of my possibilities, and, therefore, have divided my speech into three-quarters.

First quarter: *What I should have said.*

Second quarter: *What I might have said.*

Third quarter: *What I will say.*

The fourth quarter will be delivered when I become a *re*-tiring President.

First quarter: *What I should have said.*

This can be condensed. You have all heard incoming Presidents' speeches, so I will merely give a general synopsis—they are usually about as follows:

We are the finest collection of men on earth. Our aims are the highest individually and collectively; we work for the benefit of our fellows, etc.

Why you elected me President, I do not know, but I appreciate the compliment, and never again, whether leading a harp orchestra or a firing gang, will I have the proud feeling that now overwhelms me. I can merely state that as your President, I will, to the utmost of my exceedingly limited abilities, endeavor to further the interests of the association and continue the good work of my illustrious predecessors. If I succeed in doing half as well as our beloved, learned and energetic retiring President, I shall be very thankful.

Before closing, a few words relative to our work for the coming year may be advisable. You all realize the advantages our association gives its members, but unfortunately we need greater activity, increased attendance at meetings, more members should take part in the discussions, etc., etc.

In order that the association may live up to its possibilities, we need more members.

Looking forward to a busy year, during which I will have the benefit of the advice of the unusually competent and earnest, etc., etc., officers, whom you have elected, and also asking for your hearty co-operation, which I know I will receive, I now—etc.

Is not the above a fair sample of mutual laudation, self-laudation, exhilaration, and "hot air"?

Second quarter. *What I might have said.*

As engineers, we should be sure of the premises before working out conclusions. As a curious example of the contrary, I desire to call attention to the fact that nominally we do not know who will be elected officers of our society until the meeting at which the incoming officers are requested to speak. Nevertheless, they are expected to have speeches prepared. A change of date of election would give less appearance of predestination.

Therefore, I might have said—I have prepared a speech, but not having been elected, I will not deliver it, and you would have been subject to congratulations.

It might also be noted that Article VII, last paragraph,

Section 1, states: "The President shall be ineligible to re-election for five years."

Am I to understand that I have been elected for five years? It is evident that in order to be re-elected for a certain period, there must have been a previous election for a similar period.

Who wants to be President for five years? That is, except in Mexico? And even there a Colorado Madero ambition may go up in smoke.

Whilst on the subject of President, I desire to call your attention to *precedents*. Past President Osborn has an automobile, ditto Henderson, ditto others, and now ditto Frazier, I have hopes. I might add that I have been chairman of the Finance Committee during the past year, and also was somewhat instrumental in getting a bill through the Columbus Legislature during the past winter, so still have hopes.

Third quarter: *What I will say.*

As to our aims, we are a mutual aid (not philanthropic) society, both as to ourselves and others. *Each* member can benefit himself by taking advantage of the opportunities. *Each* and all members benefit by all increased facilities and activities of the association. The curve rises rapidly. When activities are exerted to the benefit of the public, as in the case of committees investigating matters of general public interest, such as harbor improvement, building code, Henke building failure, etc., not only the public, but also this society benefits.

Additional membership, even considered financially only, is desirable, as it enables more to be accomplished, but it is even more desirable to such extent as it provides more workers to assist in accomplishing.

Relative to the financial side, it is hoped that the membership dues during the coming year will be sufficient to cover operating expenses.

Living in excess of income is not advisable. At the same time I suggest that we are not a burial association, nor primarily working for the benefit of posterity, and that as long as we have a fair amount for emergencies in the treasury then applying the surplus to purchase additional equipment may be wise and consistent with good business. In the terminology of the political economist invest our "wealth" as "capital", and let it become productive. The past year has required unusual expenditures, but also there has been unusual growth. Our membership committee was exceptionally active, but did they not succeed, in part, at least, in obtaining more because they offered more?

It seems to me that an emergency fund of 10 per cent of our income—say $500.00—is sufficient, and that the excess, if properly expended, will earn *directly*, due to increased membership, far more than if in the bank (4 per cent)—and *indirectly* several hundred per cent.

I also suggest that saving for posterity is placing a tax on bachelors; is this desired?

Relative to membership, the accompanying (page 47) table is of interest. A gain of 50 per cent, or more, in one year is a

remarkable showing for an old society, and great credit is due to the membership committee, to President Frazier, and to a few others. The more central location, increased facilities and attractiveness, printed Transactions (now self-supporting), and the work of our assistant secretary, are all factors which now make it possible for us to present to prospective members a more attractive proposition than ever before. The reports one year from tonight will show how we utilized our opportunities, and my last quarter will be expended on such statement.

During the coming year we will have one unusual responsibility, but also opportunity. You are aware that due to the cooperative effort of our Society, the local members of the American Society of Mechanical Engineers, and of the Cleveland Chamber of Commerce, the next convention of the A. S. M. E. will be held in Cleveland in May, 1912. The arrangements will be in charge of our Society and of the local members of the A. S. M. E., assisted by the convention board of the Cleveland Chamber of Commerce, nevertheless it is largely "up to us" to plan and carry out the campaign. If we succeed, as we can and will, then individually and collectively we will be greatly benefited. In order to obtain maximum benefit, we must plan, start, and keep moving, and that is where the 22 per cent surplus hereafter mentioned will be useful. Our Society stands for many good things, but standing only will not "get there".

What *does* our Society "stand for"—?

There are numerous reasons for standing—

The small boy, after visiting a wood shed with his father, has his reason.

The fair dame in the hobble skirt has hers.

The man with four aces has his, down pat.

We stand because we have the habit of never "lying down" or even "sitting down" on a job, and we have numerous engineering *feats* to sustain us.

We are in the Chamber of Commerce building—just how soon we will own the building and rent a portion to the Chamber of Commerce, depends on you and others.

At any rate we have, of course, the pick of their membership, and have their first man, Adams, as our guest, this Eve.

As an Association of Engineers, we should take a lesson from modern methods of efficiency engineering, which is to show the *other* fellow how to do more.

Your retiring President has worked hard for a year. Your new president will try *not* to follow such precedent.

It seems to me that the work of the past year has been divided about as follows:

President	25 per cent
Vice President	1 per cent
Other officers	20 per cent
Committee members—	
One-half	10 per cent
One-half	44 per cent
TOTAL	100 per cent

My effort for the new year will be:

President	2 per cent
Vice President	5 per cent
Other officers	15 per cent
Committee members, and more of them	60 per cent
Other members of the Ass'n.	40 per cent
TOTAL	122 per cent

Giving surplus of 22 per cent for extra development.

Relative to our meetings, I will endeavor to run on the following schedule—I know it *can* be done, because I have done it:

Meeting called to order	7:45
Paper of evening start	8:15
Speaker notified at	9:05
Stop	9:15
Discussion closed	10:00

Adjournment.

After adjournment, informal discussion as long as any one stays for such purpose.

I also hope, and expect, that we will be able to add materially to our library before next fall.

I also desire to have you consider the advisability of making the first meeting each month one of general interest to all engineers, and the second meeting of special interest to some specific branch of engineering.

There is one clause in our by-laws which you may never have appreciated—Article VIII states that Roberts' Rules of Order are the standard. You may now appreciate how difficult it will be to appeal from the rulings of the chair.

With you, I look forward to the arrival of the time when I will deliver the fourth quarter, and would suggest that having a recall clause in the constitution might be advisable, and might hasten such time.

*TOTAL NUMBER OF MEMBERS, 1909-10-11

	ACTIVE	ASSOCIATE	CORRESPONDING	HONORARY	RETIRED	ALL MEMBERS
1909	231	50	26	7	14	328
1910	227	39	23	7	14	310
1911	361	40	36	6	15	458

THE TOASTMASTER:—I told you so. I just predicted what would happen, except that a little more happened than I had figured on. Immediately after the next song, the audience will be dismissed—and there will be no services at the grave.

STAR-SPANGLED BANNER

O say! can you see by the dawn's early light,
What so proudly we hailed at the twilight's last gleaming;
Whose broad stripes and bright stars thro' the perilous fight,
O'er the ramparts we watched, were so gallantly streaming?
And the rocket's red glare, bombs bursting in air!
Gave proof thro' the night that our flag was still there!

CHORUS

O say, does the star-spangled banner yet wave
O'er the land of the free,
And the home of the brave.

On the shore dimly seen thro' the mists o'er the deep,
Where the foe's haughty host in dread silence reposes,
What is that which the breeze, o'er the towering steep,
As it fitfully blows, half conceals, half discloses?
Now it catches the gleam of the morning's first beam,
In full glory reflected, now shines on the stream.

CHORUS

Minutes of Meetings

Regular meeting, Dec. 13, 1910, called to order by President Frazier at 8 o'clock P. M., in the fifth floor auditorium of the Chamber of Commerce building.—Present 92 members and guests.

Minutes of meetings, Oct. 11, Oct. 24 and Nov. 8, were read and approved.

The President read the Teller's report and declared the entire ballot list proposed at the last meeting, elected.

The Executive Board recommended the election of the following candidates for active membership:

R. R. Abbott	F. H. Bultman, Jr.	I. A. Greenwood	A. G. Reese
J. F. Barker	J. P. Cross	R. H. Klauder	Geo. Rettig
C. A. Black	W. M. Faber	W. B. McAllister	H. B. Thomson
H. S. Black	B. E. Foster	C. H. Patton	B. A. Tozzer

Upon motion duly seconded, the Secretary was instructed to prepare these names for letter ballot at the next regular meeting.

The Librarian reported that the Society had been given a number of valuable magazines and transactions of the American Society of Civil Engineers, from the library of A. H. Porter, a deceased member of the Society.

The paper of the evening was given by Mr. A. B. du Pont, on "Greater Cleveland's Transportation Problem", and was followed by a lively discussion, in which a number of our members took part.

Adjourned.

F. W. Ballard, *Secretary.*

Regular meeting, January 10, in the auditorium on the sixth floor of the Chamber of Commerce building.—Present 63 members and visitors.

Minutes of meeting, Dec. 13, read and approved.

Teller's report showed the election of the entire ballot, per list proposed at meeting, Dec. 13.

The Executive Board recommended the following candidates for active members:

Horace J. Allen	Rupert A. Greene	Edwin I. Heinsohn
Charles J. Buckley	George H. Hall	John F. Mullin
George C. Gordon	George W. Harper	Edward G. Stockwell

It was voted to pass these names to letter ballot.

A letter from Mrs. Jared A. Smith was read, acknowledging receipt of flowers.

The Finance, Library, Publication, Program, Membership and House Committees made verbal reports of their work.

The program for the evening was then carried out, which consisted of a paper by Mr. A. B. Roberts, on "The Design of a Factory System".

The discussion following this paper was participated in by several members.

Adjourned.

F. W. Ballard, *Secretary.*

Meeting, February 14, 1911, called to order by President Frazier in the sixth floor auditorium of the Chamber of Commerce.—Present 62 members and visitors.

Reading of minutes dispensed with.

A communication from Mrs. J. W. Seaver and family was read, acknowledging receipt of flowers; also a similar communication from the family of Gen. James Barnett. A communication was also read, in which the Geo. Worthington Co. announced the death of Gen. James Barnett, their President. A letter from the Executive Board of the Society to

Senator Krause at Columbus, protesting against the passage of Senate Bill No. 63, was read and the matter discussed.

The Teller's report showed the unanimous election to active membership of the entire ballot published at the Jan. 10 meeting.

The following candidates were recommended by the Executive Board for active members:

Ira H. Baker	Marcus H. Moffett
James Burke	Stephen H. Pitkin
James H. Herron	Edward F. Simon
William B. Hughes	Harry J. Smith
A. C. Irwin	Elliott H. Whitlock

and James A. Smith for transfer from associate to active membership.

The Secretary was instructed to prepare these names for letter ballot, to be canvassed at next regular meeting.

Resolutions prepared by Messrs. Beardsley, Paul, Mordecai, Ritchie and Wright, were accepted by the Society, made a part of the minutes, and the Secretary instructed to send a copy to the respective families: Michael Baackes and Albert H. Porter. (Resolutions published in March Journal.)

Verbal reports were then received from the Program, House, Bridge and Rivers and Harbors Committees.

Mr. Chas. H. Mitchell, of Toronto, presented a paper on "Recent Hydro-Electric Power Developments", which was greatly appreciated by those present. Many lantern slides were used to illustrate this paper, and owing to the lateness of the hour, after a few remarks by Mr. Mordecai and Mr. Roberts, the discussion was closed.

Mr. Mitchell was given a vote of thanks for his interesting and instructive paper.

Adjourned.

G. S. Black, *Acting Secretary.*

February 28, 1911.—Special meeting in Chamber of Commerce Library, called to order at 8:30 p. m. by President Frazier.—Present 60 members and guests.

Reading of minutes postponed.

The paper of the evening, "Land Surveying in and near Cleveland, 1872 to 1911", was then presented by Mr. J. D. Varney, a retired member of the Society. Instruments were exhibited to show the development of tools used for surveying during the period covered by Mr. Varney's paper.

A general discussion followed, which was participated in by Mr. Wm. H. Searles, Mr. W. R. Warner, Mr. Hosea Paul and Mr. J. C. Ulmer.

Adjourned.

G. H. Tinker, *Acting Secretary.*

March 14, 1911.—Regular meeting on the sixth floor of the Chamber of Commerce building.

Minutes of meetings, Jan. 10, Feb. 14 and Feb. 28, were read and approved.

The Tellers reported the unanimous election of the entire membership ballot published at the last regular meeting.

The following candidates were recommended by the Executive Board for election:

Active members:

Clarence E. Drayer	Edgar D. Moore
Harry G. Heaton	Kenneth S. Osborn
James L. Hunting	Richard L. Rathbone
Wilm Knox	Ralph S. Tyler
Roy B. McHenry	Frank B. Walker

Associate member: Robert L. Beck

Corresponding member: Raymond L. Pike

Upon motion duly seconded, the Secretary was instructed to prepare these names for letter ballot.

Resolutions regarding the death of General James Barnett, General

Jared A. Smith and John W. Seaver, prepared by a committee composed of Messrs. W. R. Warner, F. C. Osborn, C. W. Hopkinson, D. C. Miller, C. H. Wright, Willard Beahan, Robert Hoffmann and F. D. Davis, were approved and ordered spread on the minutes.

Reports were also received from the Finance Committee, Publication Committee, House Committee, Rivers and Harbors Committee, Bridge Committee and Building Code Committee, after which the regular program of the evening was rendered. It consisted of a paper by Mr. S. E. Doane, Chief Engineer of the National Electric Lamp Association, on "The Value of Engineering Co-Operation".

Following the reading of this very able paper, the Society adjourned.

F. W. Ballard, *Secretary.*

NOTE:—Memoirs of

Gen. Jared A. Smith

John Wright Seaver

Gen. James Barnett

Published in March Journal.

March 28, 1911.—Special meeting in the Chamber of Commerce Library, called to order by President Frazier at 8 p. m.—Present 52 members and guests.

The paper of the evening was given by Mr. J. F. Glidden, of the Glidden Varnish Co., on "The Treatment of Concrete Surfaces". Mr. Glidden showed many samples of concrete, which had been subjected to the action of acids before and after the application of surface finishes, illustrating proper and improper methods of treatment to beautify and waterproof concrete work.

A vote of thanks was tendered Mr. Glidden for his able paper.

Adjourned.

G. S. Black, *Acting Secretary.*

April 11, 1911.—Regular meeting on the sixth floor of the Chamber of Commerce building.—Present about 125 members and guests.

Minutes of meetings, March 14 and 28, read and approved.

The Tellers reported the unanimous election of the entire membership ballot, published at the last regular meeting.

The following candidates were recommended favorably by the Executive Board and passed to letter ballot by the Society:

Active members:

Luther N. Abbe	Joseph K. Gannett
Marion Balliere	Lawrence W. Jernberg
Ernest J. Batsford	Matt Luckiesh
William H. Buesser	John F. Poland
John C. Doering	Robert Wetherill, Jr.
James A. Dubbs	Harry S. Williams
Charles Eisele	Louis E. Williams

For associate member: Darwin B. Battles

For corresponding member: August H. Klotz

The following change in the Constitution was proposed:

"ARTICLE V, Section 2. Dues; Fiscal Year.—The Annual Dues shall be, for Active Members, Ten Dollars; for Associate Members, Eight Dollars; and for Corresponding Members, Five Dollars; payable in advance on the first day of June, each year. The fiscal year shall begin with the first day of June."

Changed to read—

"Section 2, Dues; Fiscal Year.—The Annual Dues shall be, for Active Members, Twelve Dollars; for Associate Members, Ten Dollars; and for Corresponding Members, Six Dollars; payable in advance on the first day of June, each year; and provided payment shall be made within thirty days from the date they become due, a rebate of Two Dollars shall be

made from the amounts above-named for Active and Associate members, and One Dollar from the amount named for Corresponding members.

"The Fiscal Year shall begin with the first day of June."

M. C. Canfield
(Signed) E. E. Ranney
E. P. Roberts

This was voted to be passed to letter ballot.

The following persons were named as a Nominating Committee to prepare a list of candidates for the elective offices for the ensuing year, as provided by the Constitution:

F. D. Davis — R. H. Smith
J. E. Grady — Aug. Mordecai
J. R. Poe — B. L. Green

C. H. Wright

Then followed the regular program of the evening, which consisted of a talk on "The Practice of Making Steel", by S. M. Rodgers, Metallurgist of the American Steel & Wire Co., Pittsburg. Many lantern slides were used to illustrate this talk, which was followed by numerous questions from those present and answers by the speaker.

A vote of thanks was tendered Mr. Rodgers for his excellent address.

Adjourned.

F. W. Ballard, *Secretary*.

April 25, 1911.—Special meeting, sixth floor, Chamber of Commerce building.—Present about 80 members and guests.

The paper was presented by Mr. J. B. Meriam, on "The Comparative Economy of Gas Engines and Other Sources of Power". Mr. Meriam used a number of lantern slides, showing data and different installations. After answering a few questions by interested members, Mr. Meriam was extended the thanks of the Society for his able paper.

Adjourned.

G. S. Black, *Acting Secretary*.

Book Reviews

THE PRACTICAL OPERATION OF ARC LAMPS

We have just received an advance copy of a new book on the "Practical Operation of Arc Lamps", edited and published by the National Carbon Co., of Cleveland, O. It contains 76 pages of intensely practical and helpful points regarding every phase of arc lamp construction and operation. Its numerous illustrations are marked and keyed in such a way that they closely hook up with the article and make it very easy for any lamp man to clearly understand the points brought out in the text.

A number of practical tables are also given. A carefully arranged index is found at the close of the book and makes it possible to easily and quickly locate any article in it. No advertisements are scattered through its pages, and the general editorial policy carried out is that of thorough and practical information which the company and its various lamp engineers and salesmen have found by years of practical experience that lamp owners and operators ask for.

A copy of the book will be sent free to anyone connected with the construction, operation, or maintenance of arc lamps of any form, upon request.

Reports of Committees

REPORT SUBMITTED FOR THE LIBRARIAN

To the Officers and Members of the Cleveland Engineering Society.

During the past fiscal year, the principal work of the Librarian has of necessity been centered upon the removal of the library from the old quarters of the Society in the Caxton building and its installation in the new rooms in the Chamber of Commerce building. This has not only been successfully accomplished, but the facilities afforded in the new quarters make the arrangement of the library such that its accessibility and general efficiency are greater than ever before in the history of the Society.

Special attention has been given to an extension of the exchange list. The additions to this list during the year 1910-11 are as follows:

United States Aeronautical Reserve, The Air Scout
The Ohio Architect, Engineer and Builder
Indiana Sanitary and Water Supply Association, Proceedings of
Canadian Engineer, The
Cornell Civil Engineer, The
Power and the Engineer
Sibley Journal of Engineering, The
Concrete
Rock Products
American Institute of Electrical Engineers, Proceedings of
Mines and Minerals
Cement and Engineering News
The Industrial World
Architectural Review
Massachusetts Institute of Technology, Science Conspectus
Municipal Journal and Engineer
Southern Electrician
Western Railway Club, Proceedings of
Steam, The Ferguson Publishing Co., Monthly
Engineering, London Publication, Weekly
Mill Supplies
The Iron Age
Southern Engineer
Mining and Scientific Press, S. F.

During the year the following gifts to the library have been received:

Cornell Civil Engineer—nearly complete set—from Messrs. Willard Beahan, F. E. Bissell and E. E. Hart.

University of Wisconsin—Bulletins Nos. 26, 38, 39, 42, 83, 197, 205, 216, 252, 264, 268, 318, 331, 337.

Metropolitan Sewerage Commission of New York—Report 1910.

U. S. Geological Survey—94 Bulletins, 43 Water Supply Papers, 19 Professional Papers.

Duplicate Vols. of Journal of the Association of Engineering Societies—from J. C. Beardsley.

The library of the late Albert H. Porter, consisting of the following bound volumes:

Transactions Am. Soc. of C. E.	36 Volumes
Engineering News	24 Volumes
Railroad Gazette	29 Volumes
Eclectic Engineering Magazine	28 Volumes
Journal Assoc. Engineering Soc.	20 Volumes

Railroad Age Gazette, several volumes, from Mr. E. E. Hart.

Engineering News, 10 volumes, from Mr. C. E. Mullen.

American Society of Civil Engineers, Transactions of, Vol. LXXXI.

Report on Elimination of Surface Freight Railroad Tracks of New York Central & Hudson River Railroad.

Report of the Superintendent of the Coast and Geodetic Survey, 1910.

Bureau of Standards, Bulletins of, Vols. I to VI, complete.

Bureau of Mines, Bulletins.

U. S. Census Bureau, Bulletins.

Interstate Commerce Commission, Statistical Reports.

A volume recently added of especial interest to the Society is the "Life and Work of Charles B. Dudley".

The following publications are received regularly:

Iron Trade Review
American Machinist
Electric Railway Journal
Electrical World
Illuminating Engineer
Engineering News
Engineering Record
Engineering Magazine
Railway and Engineering Review
Engineering Contracting
American Architect
Cement Age
Technologist
Transactions American Society of Civil Engineers
Transactions American Society of Mechanical Engineers
Transactions Canadian Society of Civil Engineers
Proceedings American Society for Testing Materials
Proceedings Brooklyn Engineers' Club
Proceedings Engineers' Society of Western Pennsylvania
Proceedings Ohio Engineering Society
Proceedings Indiana Engineering Society
Proceedings Illinois Society of Engineers and Surveyors
Proceedings Connecticut Society of Civil Engineers
Proceedings Pacific North-West Society of Engineers
Proceedings Iowa Society of Engineers
Journal of the Western Society of Engineers
Journal of the Association of Engineering Societies
Journal of the Franklin Institute
Journal of the Engineers' Society of Pennsylvania
Journal of the Ohio Society of Mechanical, Electrical and Steam Engineers
Nebraska Blue Print

Applied Science
Bulletins of the University of Wisconsin
Bulletins of the University of Illinois
Bulletins of Ohio State Board of Health
Bulletins and Papers of the United States Geological Survey
Bulletins and Papers of the United States Coast and Geodetic Survey
Barge Canal Bulletin
National Geographical Magazine
Professional Memoirs United States Corps of Engineers
Annals American Association of Political and Social Science
Bulletins of the General Electric Company
Bulletins of the Westinghouse Elec. & Mfg. Company
Bulletins of the National Electric Light Association
McClure's Magazine
Scribner's Magazine
Century Magazine
Harper's Magazine
Harper's Weekly
Munsey
Cosmopolitan

A department of book reviews in the JOURNAL has been established. This feature will undoubtedly prove of interest.

As indicated in previous reports, a library endowment fund is essential to the proper development of our library facilities.

In preparing this very brief report for the Librarian, Mr. George H. Tinker (whose illness necessitates a temporary withdrawal from some of his many activities), it gives me pleasure to call especial attention to his very thorough and efficient work for the Society.

R. H. FERNALD, *Vice Chairman.*

MEMBERSHIP COMMITTEE

Your Membership Committee finished its work for the year without having doubled the membership of the Society (as it stood at the beginning of the year, namely 310), a task set by President J. W. Frazier. The Committee realized that such would be almost too much of an undertaking in view of the progress made in previous years.

We did, however, express hope of being able to reach the 500 mark, an aim set by the Membership Committee a number of years ago, and had it not been for a number of deaths, and the dropping of a number of delinquents, besides the usual number of resignations, all of which we did not figure on sufficiently, we would have reached our goal. As it is, with our list trimmed and in better shape than ever before, we are 42 short of this mark.

The sum total of the visible results of your Committee's work can be represented by the following accessions to the membership list:

167 Active members.
10 Associate members.
9 Corresponding members.
6 Associate members promoted to full membership.

The Committee met four times during the year, considering that frequent meetings were unnecessary and merely a waste of time, after the work had once been properly assigned to the various members of the Committee. At the first meeting, all of the active members being present, a list of about 150 names of prospective members was gone over and the names of other prospects added, each Committee member assuming to approach from five to ten men. It was decided that better results could be expected if each member attempted but a reasonable task and reported on the success at the next meeting, rather than to assume too big a task, even though a year's time remained in which to accomplish it, with the usual result of finding it unfinished at the expiration of that period.

It was also decided to prepare and have printed an invitation to be handed out or mailed to prospective members, setting forth the advantages of membership in the Society and also to prepare a new application blank to contain all of the necessary information, usually asked by prospective members, in the form of extracts from the Constitution.

After seeing as many prospective members as possible personally, a campaign by mail was instituted, our mailing list having been increased to 229 by new names suggested, to which was added a list of 330 names which our Secretary, Mr. F. W. Ballard, in a very painstaking manner prepared from various lists as referred to in the last Report of the Membership Committee published in the March JOURNAL, though the count of 750 names there given was obviously in error.

It may be interesting to note that while selections were made in an unprejudiced manner, largely from a viewpoint of convenience of the Committee members in seeing them, and naturally with regard to the acquaintance of Committee members with these prospective members, over 16 per cent of the men on the list handed down by the previous Membership Committee, revised and augmented by your present Committee, joined the Society, whereas only 8.8 per cent of the men on the list prepared by Secretary Ballard were "landed" as members.

The mail campaign was productive, to date, in securing about 12 new members, some of whom may have been personally approached before, and that means about 3.4 per cent, approximately 360 letters having been sent out. No doubt time will bring further results.

There is no doubt but that some of this work will bring returns during the next year, and we confidently believe that, even if no membership campaign were directly attempted next year, at least 50 men will join the Society as a result of this year's campaign. It is interesting also to note that by far the majority of men who joined the Society were such whose names did not appear on our lists, but were men secured by personal solicitation, apart from the pre-conceived notions and plans; and in that respect membership work resembles salesmanship and business-getting, which always points out, as the most productive way of getting results, the going out and searching for interested

parties rather than mapping out campaigns with the aid of directories, trade reports and atlases.

We would heartily recommend the establishment of a card index of prospective members, to be kept in duplicate, one card to remain in the hands of the Secretary of the Society and the other to be handed to the Committee member agreeing to visit a prospective member, these cards to bear record of previous calls made and the dates to which the candidate may have postponed his decision. After a man has been approached in a dignified and forceful manner and has declined to come into the Society, his name should be dropped and not handed down to the next Committee, but a record of such should be kept to prevent unnecessary duplication of effort.

It is estimated that there are 1,500 eligible men in Cleveland and that our Society should harbor at least one-half of that number, and, if that be true, the next Committee will have plenty of work. It might be well to consider going over the city directory and sending letters to all draughtsmen, mechanical, civil, electrical and mining engineers, and it is reasonable to expect that from a mere campaign by mail 5 per cent of the men approached will affiliate with us. We would urge that the cooperation of the entire membership be at all times expected and asked for, and that Committeemen and members be induced to report back their experience with prospective members to prevent unnecessary repetition of work.

Your Membership Committee has the satisfaction of having approached every eligible man referred to it or heard of by it, and there is no doubt that the Cleveland Engineering Society is better known today as the result of this effort.

Sincerely thanking you for the opportunity of rendering this service, which has gotten such gratifying results, we remain,

DAVID GAEHR, *Chairman.*

PROGRAM COMMITTEE

The Program Committee met, Aug. 1, and immediately commenced arrangements for the annual outing—a trip to Erie, Pa. The party left Cleveland at 7:30 A. M., Aug. 24, and after visiting a number of the large works at Erie, spent the evening at Waldemere Park, returning to Cleveland by night boat.

Early in the year, owing to pressure of out-of-town business, Mr. Geo. B. Dusinberre felt obliged to give up the position of Chairman of the Committee, but remained a member and gave valuable assistance in various ways.

At the request of the administration, the Committee endeavored to provide a special meeting every month, thereby furnishing two programs each month instead of one. The following programs were prepared:

SEPT. 27.—*Mr. Robert Hoffmann*—"Grade Crossing Elimination".
OCT. 11.—*Mr. A. M. Felgate*—"The Rocky River Arch".

Oct. 24.—A visit to Technical High School on invitation of Prof. Barker, was enjoyed by a number of our members.
Nov. 8.—(Ladies' Night)—*Mr. W. R. Warner*—"An Evening with the Planets and Stars".
Dec. 13.—*Mr. A. B. duPont*—"Greater Cleveland's Transportation Problem".
Jan. 10.—*Mr. A. B. Roberts*—"The Design of a Factory System".
Jan. 24.—*Prof. M. M. Wood*—Special lecture on the Gyroscope.
Feb. 14.—*Mr. C. H. Mitchell*—"Recent Hydro-Electric Power Developments".
Feb. 28.—*Mr. J. D. Varney*—"Land Surveying In and Near Cleveland, 1872 to 1911".
March 14.—*Mr. S. E. Doane*—"The Value of Engineering Co-Operation".
March 28.—*Mr. J. F. Glidden*—"The Treatment of Concrete Surfaces".
April 11.—*Mr. S. M. Rodgers*—"The Practice of Making Steel".
April 25.—*Mr. J. B. Meriam*—"The Comparative Economy of Gas Engines and Other Sources of Power".
May 9.—*Mr. A. B. Burk, Jr.*—"Storage Batteries".
May 23.—*Mr. Claiborne Pirtle*—"Some Recent Improvements in Electric Motor Control".

So far as we are aware, a new departure was instituted in arranging for a lecture on the "Gyroscope", by Prof. M. M. Wood, of Chicago. An admission fee was charged, and the result seems to indicate that it would be advisable to hold one or two popular lectures every year.

Four papers are being prepared and can be arranged for in the early fall. The Committee has prepared a file for proposed papers and papers under preparation, which we hope may prove of value to the incoming Program Committee.

E. H. Owen, *Chairman.*

PUBLICATION COMMITTEE

As the four numbers of the Journal, issued during the year, evidence more clearly the work of the Publication Committee than anything we could add in a final report, we feel that about the only thing of interest we can present at this time will be a short statement of the financial end of this work, which follows:

	Cost of Journal	Number of Pages Reading Matter	Number of Pages Advertising	Income from Advertising
Vol. III, No. 1....	$195.66	56	11	$111.25
Vol. III, No. 2....	168.40	58	14	179.25
Vol. III, No. 3....	213.11	81	20	265.75
Vol. III, No. 4....	.....	..	24	322.25

A word concerning the assistance the Program Committee can render the Publication Committee may not be amiss in this connection. At the commencement of the year, your Committee was considerably handicapped in its work through inability to secure promptly for publication, papers which had been read

during the preceding year; in some cases, it did not seem even to be understood by the man presenting a paper that his manuscript was desired for publication.

For the benefit of our successors, we therefore urge the Program Committee to observe more closely the intent of ARTICLE VI, Section 5, of the Constitution, which provides that papers shall be turned over to the Society promptly. Strict observance of this rule will greatly aid the Publication Committee in its work.

GEO. F. BURROWS, *Chairman.*

Financial Report

Cleveland, O., June 12, 1911.

Mr. F. W. Ballard, *Secretary*,
The Cleveland Engineering Society,
Cleveland, O.

Dear Sir:—

Pursuant to your request, I have made an examination of the cash book of the Cleveland Engineering Society, for the year ending May 31, 1911, and have therefrom made the following statements:

Cash Receipts and Disbursements, Permanent Fund.
Cash Receipts and Disbursements, Library Fund.
Cash Receipts and Disbursements, Commercial Account.

I Hereby Certify, That the statements submitted herewith are true and correct, as shown by the cash book of the Cleveland Engineering Society.

Respectfully submitted,
J. B. Tanner,
Certified Public Accountant.

Cash Receipts and Disbursements

THE CLEVELAND ENGINEERING SOCIETY

Year Ending May 31, 1911.

COMMERCIAL ACCOUNT

Cash in bank (June 9, 1910)	$ 45.26	
Receipts:—		
For detail see Schedule "A"	5,461.34	$5,506.60
Disbursements:—		
For detail see Schedule "B"		5,198.64
Balance on hand, June 1, 1911		$ 307.96
In Commercial National Bank	$ 289.46	
In office for deposit	18.50	
	$ 307.96	

Cash Receipts and Disbursements
THE CLEVELAND ENGINEERING SOCIETY
Year Ending May 31, 1911.

PERMANENT FUND

Cash in bank (June 3, 1910)		$1,457.65
Receipts:—		
Fees	$ 900.00	
Interest on bank deposits	48.70	
Total cash receipts		948.70
		$2,406.35
Disbursements:—		
Transferred to commercial account (November, 1910)		1,300.00
Balance in fund, May 31, 1911		$1,106.35
In Society for Savings, account No. 359155	$ 961.35	
In office for deposit	145.00	
	$1,106.35	

LIBRARY FUND

Cash in bank (June 1, 1910)	$1,114.80	
Receipts:—		
Interest on bank deposits	45.50	$1,160.30
Disbursements:—		
Transferred to commercial account (March, 1911)		160.00
Balance in fund, May 31, 1911		$1,000.30
In Superior Savings & Trust Company, account No. 4856	$1,000.30	

Schedule "A"—Cash Receipts, Commercial Account

THE CLEVELAND ENGINEERING SOCIETY

Year Ending May 31, 1911.

Dues:—		
Active membership	$2,427.50	
Associate membership	246.00	
Corresponding membership	96.25	
Delinquent	129.00	$2,898.75
Coupons:—		
Cigars	$ 44.45	
Billiards and pool	44.80	
Outstanding coupons	3.25	92.50
Rental:—		
Club rooms		15.00
Tickets:—		
Lecture by M. M. Wood		173.50
Pins:—		
Society emblems		40.00
Program Committee:—		
.....		144.05
Publication Committee:—		
Advertising	$ 615.06	
Journal subscription	2.00	
Reimbursement for cuts	20.48	637.54
Total "commercial" receipts		$4,001.34
Transfer:—		
From permanent fund	$1,300.00	
From library fund	160.00	1,460.00
Total receipts		$5,461.34

Schedule "B"—Cash Disbursements, Commercial Account

THE CLEVELAND ENGINEERING SOCIETY

Year Ending May 31, 1911.

General Administrative Expense:—		
Rent, club rooms	$1,201.66	
Rent, extra, assembly rooms	140.00	
Salaries	1,023.32	
Printing and stationery	293.69	
Postage	171.10	
Insurance, fire	16.20	
Taxes	4.48	
Telephone rental	45.00	
Telephone, toll charges	1.88	
Flowers	45.00	
Advertising	27.63	
Electric light	33.68	
Sundry expenses, including office supplies and expenses	200.22	
Billiards and pool	28.55	$3,232.41
Relocation Expense:—		
Moving, drayage, cleaning	$ 69.80	
Electric wiring and fixtures	117.22	
Removal of partitions, repairs, etc.	258.19	445.21
Capital Expenditure:—		
Furniture and fixtures, new	$ 315.29	315.29
Rebate on dues		2.50
Cigars		52.58
		$4,047.99
Library:—		
Books, new	$ 9.29	
Periodicals	50.60	
Binding, etc.	36.80	
Dues, Am. Society for Testing Materials	15.00	
Dues, Int. Association for Testing Materials	2.00	113.69
Program Committee:—		
Printing, postage, stationery, etc.	$ 52.08	
Speakers and papers	77.35	
Entertaining	310.15	439.58
Publication Committee:—		
Printing, postage, etc.	$ 65.17	
Printing and illustrating (Journal)	532.21	597.38
Total "commercial" disbursements		$5,198.64

Recapitulation—Cash Receipts, Disbursements, Balances

THE CLEVELAND ENGINEERING SOCIETY

Year Ending May 31, 1911.

	CASH BALANCE JUNE, 1910	RECEIPTS	DISBURSEMENTS	CASH BALANCE MAY 31, 1911
Permanent fund.....	$1,457.65	$ 948.70	$(*a*) 1,300.00	$1,106.35
Library fund.....	1,114.80	45.50	(*b*) 160.00	1,000.30
Commercial account....	45.26	(*c*) 5,461.34	5,198.64	307.96
	$2,617.71	$6,455.54	$6,658.64	$2,414.61

(*a*) Transferred to commercial account.
(*b*) Transferred to commercial account.
(*c*) Including $1,460.00 from permanent and library funds.

BALANCE SHEET, THE CLEVELAND ENGINEERING SOCIETY, AS AT THE CLOSE OF BUSINESS, MAY 31, 1911

ASSETS:—		
Cash—		
Permanent Fund	$1,106.35	
Library Fund	1,000.30	
Commercial Account	307.96	$ 2,414.61
Petty Cash—G. S. Black		20.00
Accounts Receivable—		
Dues, 1911-12—Active:		
361 @ $12.00	$4,332.00	
Dues, 1911-12—Associate:		
40 @ 10.00	400.00	
Dues, 1911-12—Corresponding:		
36 @ 6.00	216.00	
Dues, 1911-12 and prior, Schedule "A"	108.00	$ 5,056.00
Advertisers, Schedule "B"		66.25
American Society of Mechanical Engrs., Schedule "F"		10.32
Notes Receivable—		
G. S. Hanford		22.00
Furniture and Fixtures—		
Schedule "C"	1,739.05	
Library Equipment—		
Schedule "D"	586.75	
Books—		
Schedule "D"	3,000.00	$ 5,325.80
Cigars		22.50
Society Emblem—		
(Pin)—Three @ $2.00		6.00
Total		$12,943.48
LIABILITIES:—		
Accounts Payable—		
Schedule "E"		$ 1,007.95
Reserve Accounts—		
For dues, 1911-12:		
Active, 361 @ $2.00	722.00	
Associate, 40 @ 2.00	80.00	
Corresponding, 36 @ 1.00	36.00	$ 838.00
Coupons Outstanding—		
Schedule "G"		3.25
Total		$ 1,849.20
Surplus		11,094.28
		$12,943.48

Employment Bulletin

This Department is for the use of members desiring positions or requiring engineering services; it is under the personal direction of the Secretary, who is anxious to increase its value to the members. Therefore, if you are in need of engineering help, or desire to secure a position, do not hesitate to call on the Department for assistance.

All information is handled confidentially.

POSITION VACANT

No. 4V.—High-grade machine tool salesman; preferably a man about 35 years of age, who has had shop and some commercial experience, with technical education.

MEN AVAILABLE

No. 5A.—American, 28 years of age, two years at Drexel Institute, four years at University of Pennsylvania, desires railroad position. Has had seven and a half years' experience in railroad work, covering construction, maintenance, bridge and grading, surveying, location, and three years as assistant engineer.

No. 6A.—American, 34 years of age, married, graduate of Ohio State University, M. E., desires position as superintendent or master mechanic. Experienced in machine and pattern shop, and drafting on boilers, engines, gas producers, heating furnaces, blast furnaces and stoves; also had charge of large pumping station for some time.

No. 7A.—Case School graduate desires position as superintendent of construction, or with engineering party. One year's experience with mechanical engineering firm, and one year's experience in architectural work. Has also had some experience in allotment work with real estate firms.